U.S. Fish and Wildlife Service

Federal Aid In Wildlife Restoration

ALASKA

JOB COMPLETION REPORTS — NOT FOR PUBLICATION

Project W-3-R-11 Alaska June 30, 1957

Wildlife Investigations

Caribou Management Studies

March 31, 1956 - April 30, 1957

Personnel

Robert F. Scott, Leader
Sigurd T. Olson, Wildlife Mgt. Biologist.
David R. Klein, " " "
Ronald O. Skoog, " " "
Robert A. Rausch, " " "
Alan M. Courtwright, Biological Aid
James L. Whisenhant, " "
Dustin L. Sloan, " "
Peter E. K. Shephard, " "

Robert F. Scott
Supervisor, Game Restoration

Clarence J. Rhode
Executive Officer
Alaska Game Commission

ALASKA GAME COMMISSION

JUNEAU

C O N T E N T S

Job No. 1--Forage Requirements and Range Use--Nelchina Caribou Herd

Period Covered: 1953 and 1954

ABSTRACT

The vegetation at eighteen localities in the eastern half of the Nelchina caribou range was sampled during 1953 and 1954. Five of these areas were classified as above timberline, ten as below timberline, and three as lowland. A total of 65 transect lines was run, and these included 1,068 meter-square quadrats, of which 122 were clip quadrats. The results were tabulated to obtain the per cent occurrence and the per cent density of the plants occurring in the quadrats at each locality. The air-day weights of the plants removed from the clip-quadrats were tabulated to obtain the average weight in grams for the plants at each locality. The data obtained are not sufficient to be applied to the entire range, but will serve as a base for future investigations.

OBJECTIVES

To gather information regarding the forage requirements of northern caribou and regarding the effect of caribou use on tundra ranges.

TECHNIQUES USED

The first studies of the Nelchina caribou range took place during the summers of 1953 and 1954, their purpose being to gather basic data concerning the plant composition and forage production of the region. Eighteen localities lying at various sections within the eastern half of the range were sampled by a two-man crew--George Schaller and Alan Courtright in 1953, and Lyman Nichols and Jack Gross in 1954. The localities checked included both above and below timberline areas, most of them accessible by airplane; most of them lay in the winter range of the caribou. The data gathered were intended to be used eventually for determining the carrying capacity of the caribou range. This report on findings has been delayed due to the untimely death of Assistant Leader Chatelain who was directing the project.

The localities sampled were chosen so as to include plant communities as nearly as possible representative of the range vegetation as a whole. All lay within the main portion of the caribou range except five--Ed, 2nd, Nichols, High, and Mankomen Lakes--which lay in areas on the fringe where caribou had not occurred in any numbers for some time. It was thought that these five could be compared with the localities sampled in the main part of the range (those having similar vegetation) to determine the effect of caribou utilization.

The vegetation at each site was sampled by meter-square quadrats equally spaced, about 16 to the mile (one every 110 yards) along random

transect lines. Although equally spaced, the quadrats were laid out so as to sample all of the major plant-cover types occurring at each site. Visual estimation provided the means for determining the density of each plant species (or type) in each quadrat, the density being recorded as the per cent of the total quadrat area covered by the plant foliage. For the forage-production portion of the study, in approximately every tenth quadrat the vegetation was clipped to the ground level, sorted by species, air-dried, and later weighed.

FINDINGS

The vegetation at eighteen localities was sampled during the two-year study. Their approximate locations are shown in Figure 1; Table 1 lists their locations by longitude and latitude. Five of these areas were classified as above timberline, ten as below timberline, and three as lowland. The writer is not sure what criteria were used to separate below timberline areas from lowland, but assumes that the separation was strictly on the basis of altitude and slope; results of the sampling indicated that the vegetative differences between the two areas were minor. During the study 65 transect lines were run (29 in 1953 and 36 in 1954); these included 1,068 meter-square quadrats (511 in 1953 and 557 in 1954), of which 122 were clip quadrats (79 in 1953 and 43 in 1954). Table 2 summarizes this information for the two years.

Seven of the localities sampled lay on the "flat" between Lone Butte and the Richardson Highway, where caribou have wintered frequently in past years. This flat covers about 2,000 square miles of the southeast quadrant of the Nelchina range, lying at an average elevation of about 2,400 feet. The region is poorly drained, containing many lakes and muskeg areas, and supports a sub-climax stand of black spruce (Picea mariana). The primary associated plants include willow (Salix spp.), dwarf birch (Betula nana), Labrador tea (Ledum spp.), blueberry (Vaccinium uliginosum), low-bush cranberry (V. vitis-idaea), crowberry (Empetrum nigrum), cloudberry (Rubus chamaemorus), sedges (Carex, Eriophorum, and Scirpus), and many forms of mosses, lichens, and fungi. In this area, 338 quadrats were examined, of which 50 were clip quadrats, at Harris Lake, Tyone Lake, Georgia Lake, Gross Lake, Springer Lake, Sourdough, and along the Lake Louise road.

Five of the localities lay in areas above timberline along the eastern edge of the Talkeetna Mountains. From north to south, these are located at Deadman Lake, Clarence Lake (2), Black Lake, and a site some four miles north of Leila Lake which lies at about Mile 121 on the Glenn Highway. Basically the sites contain greatly similar vegetation--the dominant vegetation being lichens, sphagnum moss (Sphagnum sp.), sedges, grasses, crowberry, blueberry, and low-bush cranberry--but the densities of each plant-type vary with the dampness of the site. The sample included 333 quadrats, of which 31 were clip quadrats.

The remaining six sites were located in areas below timberline, but generally in more hilly terrain than that evident on the "flat."

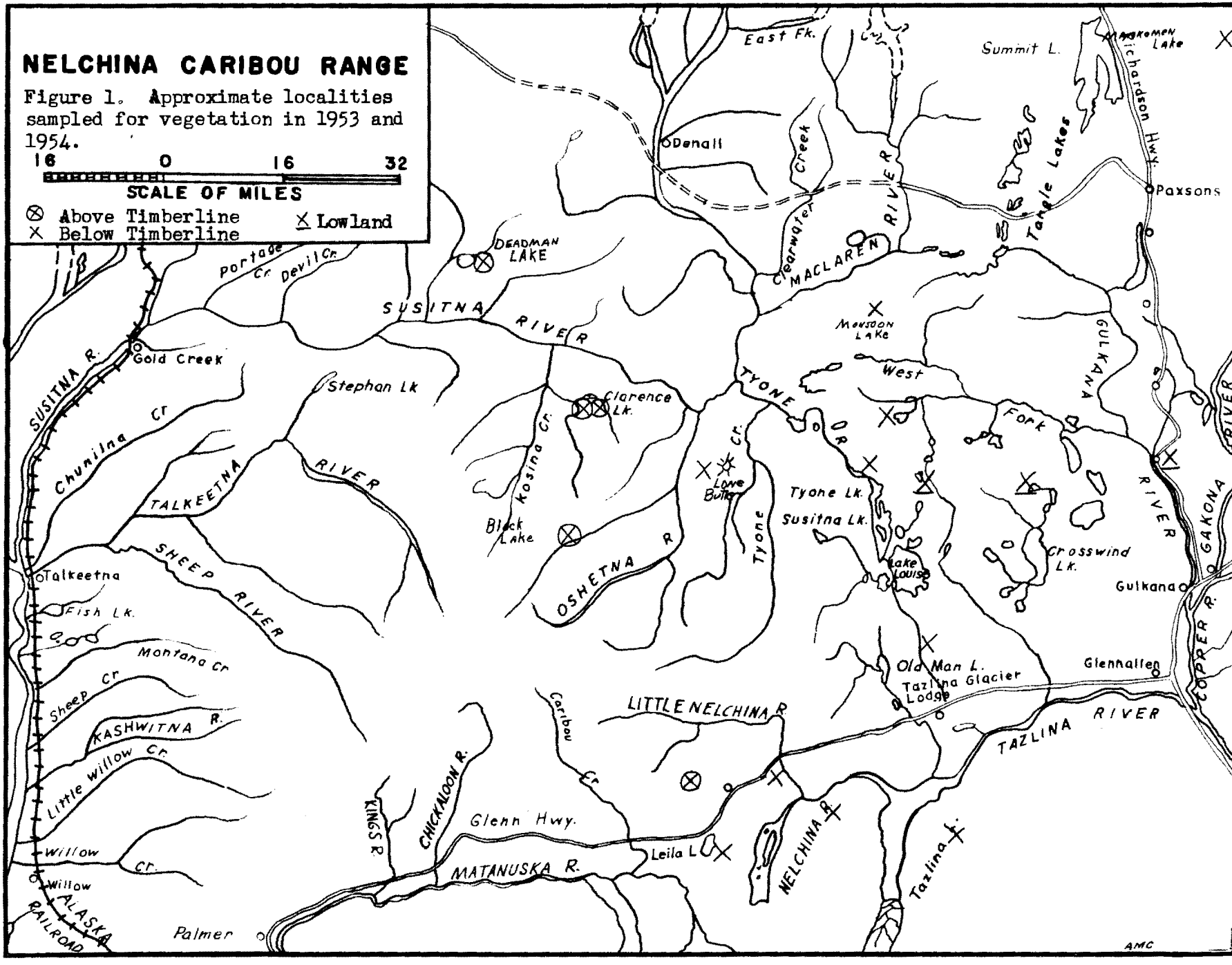

NELCHINA CARIBOU RANGE
Figure 1. Approximate localities sampled for vegetation in 1953 and 1954.
16 0 16 32
SCALE OF MILES
⊗ Above Timberline
× Below Timberline
⊻ Lowland
East Fk.
Summit L.
Richardson Hwy.
Paxsons
Denali
Clearwater Creek
MACLAREN RIVER
Tangle Lakes
DEADMAN LAKE
Portage Cr.
Devil Cr.
SUSITNA RIVER
Monsoon Lake
West Fork
GULKANA RIVER
SUSITNA R.
Gold Creek
Stephan Lk
Clarence Lk.
TYONE R.
Chunilna Cr.
TALKEETNA RIVER
Kosina Cr.
Black Lake
Love Butte
Tyone Cr.
Tyone Lk.
Susitna Lk.
Lake Louise
Crosswind Lk.
GAKONA RIVER
Talkeetna
SHEEP RIVER
OSHETNA R.
Fish Lk.
Montana Cr.
Sheep Cr.
KASHWITNA R.
Little Willow Cr.
Willow Cr.
Willow
ALASKA RAILROAD
Palmer
KINGS R.
CHICKALOON R.
Caribou Cr.
LITTLE NELCHINA R.
Glenn Hwy.
MATANUSKA R.
Leila L.
NELCHINA R.
Tazlina L.
Old Man L.
Tazlina Glacier Lodge
Glennallen
TAZLINA RIVER
COPPER R.
Gulkana
AMC

Table 1. Localities sampled during 1953 and 1954, located by longitude and latitude

Locality	Altitude (feet)	Longitude	Latitude
1953			
Glenn Highway	3500	147° 20' E	61° 56' N
Lake Louise Road	2800	146° 28' E	62° 07' N
Black Lake	4000	147° 52' E	62° 24' N
Clarence Lake	3500	147° 47' E	62° 42' N
Deadman Lake	3200	148° 15' E	63° 01' N
Harris Lake	2800	147° 24' E	62° 31' N
Monsoon Lake	3000	146° 37' E	62° 49' N
Tyone Lake	2500	146° 40' E	62° 30' N
Sourdough	1800	145° 29' E	62° 31' N
1954			
Ed Lake	2500	146° 57' E	61° 58' N
2nd Lake	2500	146° 49' E	61° 57' N
Nichols Lake	3200	147° 12' E	61° 51' N
High Lake	3200	146° 18' E	61° 52' N
Clarence Lake	3500	147° 47' E	62° 42' N
Georgia Lake	2500	146° 40' E	62° 37' N
Mankomen Lake	3200	144° 33' E	63° 00' N
Springer Lake	2300	146° 00' E	62° 29' N
Gross Lake	2500	146° 28' E	62° 32' N

Table 2. Summary of the 1953 and 1954 Nelchina caribou range studies, showing locations, type areas, and amount of vegetation sampling done.

Date	Location	Type Area	Transects Total	Transects No.	Total Quadrats	Clip Quadrats
1953						
6/6-17	M.121,Glenn Hy.	Above Timberline	2	1-2	60	0
6/18-25	Lake Louise Rd.	Below Timberline	1	3	34	0
7/1-6	Black Lake	Above Timberline	4	4-7	65	8
7/7-15	Clarence Lake	" "	4	8-11	64	8
7/16-20	Deadman Lake	" "	4	12-15	64	8
7/29-8/4	Harris Lake	Below Timberline	4	16-19	64	16
8/5-10	Monsoon Lake	" "	3	20-22	48	12
8/10-15	Tyone Lake	" "	2	23-24	32	7
8/15-24	Sourdough	Lowland	5	25-29	80	20
Total	9		29		511	79
1954						
6/8-15	Ed Lake	Below Timberline	6	1-6	87	8
6/15-19	2nd Lake	" "	4	7-10	64	3
6/19-25	Nichols Lake	" "	5	11-15	70	7
6/25-7/2	High Lake	" "	5	16-20	80	7
7/2-14	Clarence Lake	Above Timberline	5	21-25	80	7
7/18-24	Georgia Lake	Below Timberline	4	26-29	64	2
7/24-8/3	Mankomen Lake	" "	3	30-32	48	4
8/4-8	Springer Lake	Lowland	2	33-34	32	2
8/8-14	Gross Lake	"	2	35-36	32	3
Total	9		36		557	43
Final Total	18		65		1068	122

Four of these sites occurred south of the Glenn Highway--Ed Lake, 2nd Lake, Nichols Lake, and High Lake--the first three lying near the upper Nelchina River and the last, near Tazlina Lake; caribou have not frequented that region in numbers for many years. The fifth site was located at Monsoon Lake, lying between the Maclaren River and the upper reaches of the West Fork of the Gulkana River; caribou commonly pass through that area. The sixth site was at Mankomen Lake, which is located some thirty miles east of Summit Lake; caribou seldom reach that portion of the range. The vegetation of all these areas corresponds closely with that indicated above for the "flat". The sampled sections contained much sphagnum moss, with lichens, sedges, blueberry, and low-bush cranberry being common. A total of 397 quadrats was used to sample these areas, including 41 clip quadrats.

Tables 3 and 4 show the plant compositions of the various localities sampled during the two years, as determined by visual estimation of plant densities (foliage coverage) in meter-square quadrats along random transect lines. Herbs encountered include the following:

Achillea sp.
Anemone sp.
Astragulus umbellatus
Brassica sp.
Cornus canadensis
Corydalis sp.
Dodecatheon macrocarpum
Epilobium angustifolium
E. latifolium
Linnaea borealis
Lupinus arcticus
Mertensia paniculata
Oxytropis nigresceus
Pedicularis lapponica
Petasites frigidus
Polemonium acutiflorum
Polygonum viviparum
P. bistorta
Potentilla emarginate
Pyrola secunda
Rannunculus occidentalis
Rhododendron lapponicum
Rubus chamaemorus
Rumex sp.
Saxifraga bronchialis
S. tricuspidata
Senecio atropurpureus
Solidago sp.
Stellaria sp.
Swertia perennis
Therofon richardsonii
Valeriana sp.
Zygodenus elegans

Lichens, sedges, grasses, and fungi were not identified by genus or species, other than noting the more common genera present.

Tables 5 and 6 show the results obtained from the 122 clip quadrats taken during the two years. The figures shown are the average total number of grams per quadrat for each plant listed. All weights expressed are on an air-dry basis.

Neither the plant-composition nor plant-weight data can be considered as representative of the whole Nelchina range, because large areas remain unsampled as yet. This report simply condenses the information obtained during 1953 and 1954. All of the raw data is filed at the Anchorage office of the Federal Aid branch.

Table 3. Plant composition at various sections of the Nelchina caribou range, as determined by visual estimation of plant coverage of meter-square quadrats along random transect lines--1953

PLANTS	GLENN HWY.		LAKE LOUISE ROAD		BLACK LAKE		CLARENCE LAKE		DEADMAN LAKE		HARRIS LAKE		MONSOON LAKE		TYONE LAKE		SOURDOUGH	
	o	d	o	d	o	d	o	d	o	d	o	d	o	d	o	d	o	d
LICHENS:																		
Foliose	30	2	71	7	20	2	13	2	11	1	44	3	56	3	100	12	85	12
Fruticose	82	29	91	25	77	15	81	39	91	41	91	33	92	40	100	34	93	19
WOODY:																		
Alnus sp.			6	T														
Andromeda sp.							3	0.2									4	0.2
Arctostaphylos alpina	15	0.4	35	2	11	2	16	2	25	2	16	0.8	17	0.6	19	0.5	15	0.7
A. uva-ursi	5	2	6	2			2	T					6	0.5			6	0.6
Betula nana	55	0.1	59	0.2	23	3	73	4	6	5	77	5	67	3	63	3	78	12
Cassiope spp.	5	0.7			23	2	14	0.5	22	2								
Dryas spp.	30	3			18	4												
Empetrum nigrum	60	11	76	11	49	7	58	6	63	7	61	5	71	5	38	2	16	8
Ledum spp.	33	0.2	94	4	12	0.7	70	4	41	1	84	5	79	6	97	6	95	14
Loiseleuria decumbens					6	0.6	6	0.4	39	4								
Oxycoccus microcarpus											26	0.2	8	0.1	13	0.1	16	0.2
Picea spp.	2	T	15	T			2	0.1									10	0.5
Populus spp.			3	T									2	T			16	6
Potentilla fruticosa	8	T	9	T	14	0.7	5	0.3	8	0.4					3	T	10	0.3
Rosa acicularis	5	T	15	0.1	2	T					14	0.4	6	0.1	16	0.1	13	0.3
Salix spp.	60	1	71	3	72	14	45	6	58	6	45	3	42	3	69	6	48	3
Spirea beauverdiana	3	T			5	0.1	11	0.3			6	0.4	23	0.8			6	0.1
Vaccinium uliginosum	38	2	94	14	46	5	84	8	84	7	98	8	79	7	94	6	86	10
V. vitis-idaea	60	3	56	3	45	3	77	4	70	3	92	5	94	4	97	5	93	9
SEDGE-GRASS	88	13	71	9	100	19	95	9	88	6	91	9	85	4	97	5	90	7
HERBS	82	2	76	0.7	62	3	53	1	47	2	81	7	77	3	72	3	53	2
*MOSS	83	26	91	8	92	29	86	18	78	14	98	24	92	30	100	33	86	21
OTHER:																		
Equisetum spp.	8	1	18	0.5	6	0.1	6	0.1	3	0.2	13	0.4			31	0.3	19	0.1
Fungi											3	T	2	T			3	0.1
Lycopodium sp.			3	0.1	12	1	8	0.2	3	0.2			10	0.2			1	T
BARE	3	1			6	0.6	2	T	2	0.1	2	0.2					1	0.1

*Includes Sphagnum sp.

o Occurrence--% of quadrats w/plant

d Average plant coverage (%)--based on all quadrats

T Trace

Table 4. Plant composition at various sections of the Nelchina caribou range, as determined by visual estimation of plant coverage of meter-square quadrats along random transect lines--1954

PLANTS	ED LAKE		2ND LAKE		NICHOLS LAKE		HIGH LAKE		CLARENCE LAKE		GEORGIA LAKE		MANKOMEN LAKE		SPRINGER LAKE		GROSS LAKE	
	o	d	o	d	o	d	o	d	o	d	o	d	o	d	o	d	o	d
LICHENS:																		
Foliose	90	20	67	11	63	7	64	5	40	2	91	12	44	3	63	3	91	5
Fruticose	93	20	86	13	54	8	74	3	100	37	97	16	48	2	81	39	97	36
WOODY:																		
Andromeda sp.	1	T			7	T	8	T	4	T	8	T	10	T	3	T	3	T
Arctostaphylos alpina							1	T	11	1	2	T	8	0.3	19	0.2		
A. uva-ursi					1	T	1	T										
Betula nana	77	1	14	T	76	1	76	0.8	85	0.9	69	0.4	65	0.5	38	0.2	69	0.3
Cassiope spp.							6	T	11	0.2								
Dryas spp.									1	T								
Empetrum nigrum	68	6	86	4	70	4	60	8	83	3	38	0.6	31	2	38	0.7	31	0.3
Ledum spp.	79	2	75	0.5			55	0.8	78	1	92	2	13	0.1	100	2	78	0.5
Loiseleuria decumbens									4	2								
Oxycoccus microcarpus					7	T	9	0.1	6	T	30	T	10	T	16	T	25	T
Picea spp.	17	T	23	0.1			10	0.1					8	T	41	T	34	T
Potentilla fruticosa	8	T	3	T	17	0.1	14	T					21	0.1				
Rosa acicularis	3	T	11	T	7	T	15	T	1	T	8	T	8	T	3	T		
Salix spp.	31	0.3	44	0.3	63	1	70	1	24	0.2	41	0.3	73	1	63	0.1		
Spirea beauverdiana									5	T	9	T	2	T				
Vaccinium uliginosum	84	2	63	1	84	1	49	1	91	3	91	2	42	0.7	91	3	69	0.4
V. vitis-idaea	78	1	63	0.9	63	0.1	64	0.4	95	2	97	4	52	0.4	97	2	100	1
SEDGE-GRASS	84	2	67	0.4	89	6	75	4	86	2	98	5	100	11	75	3	94	5
HERBS	17	T	53	T	39	T	43	0.1	20	0.1	91	0.3	88	0.1	91	0.2	91	T
*MOSS	92	28	98	59	99	53	96	36	96	26	100	48	98	64	97	42	94	35
OTHER:																		
Equisetum spp.	15	T	45	0.1	47	T	25	0.1			33	T	50	0.3	44	0.1	25	T
Fungi			3	T					1	T					25	T	3	T
Lycopodium spp.	41	1			1	T	21	0.3	4	0.1	2	T	2	T				
BARE	89	15	81	10	59	11							2	2				

*Includes Sphagnum sp.

o Occurrence--% of quadrats w/plant

d Average plant coverage (%)--based on all quadrats

T Trace

Table 5. Air-dry weights of plants removed from clip-quadrats in 1953, expressed in average grams per quadrat.

PLANTS	BLACK LAKE (8)¹	CLARENCE LAKE (8)¹	DEADMAN LAKE (8)¹	HARRIS LAKE (16)¹	MONSOON LAKE (12)¹	TYONE LAKE (7)¹	SOURDOUGH (20)¹
LICHENS:							
Foliose	5.7		0.9	6.7	4.3	25.3	25.0
Fruticose	78.0	552.6	558.8	306.1	287.0	357.6	120.6
WOODY:							
Andromeda sp.						0.1	0.1
Arctostaphylos alpina	14.6	2.9	3.3	0.9	0.8		1.9
A. uva-ursi	0.3		0.4				1.6
Betula nana	1.1	5.7	2.4	2.9	1.8	3.2	5.6
Cassiope spp.	30.2		8.2				
Dryas spp.	6.7						
Empetrum nigrum	54.9	41.5	37.6	20.7	35.2		6.3
Ledum spp.	1.7	9.3	1.0	16.0	13.2	22.8	23.4
Loiseleuria decumbens	9.7	5.3	35.7				
Oxycoccus microcarpus				0.4	T	0.6	T
Picea spp.							0.2
Populus spp.							0.1
Potentilla fruticosa	0.8					0.1	0.6
Rosa acicularis				0.1	0.1	0.3	0.2
Salix spp.	1.6	0.5	2.2	5.0	5.5	17.8	6.6
Spirea beauverdiana		0.3	0.1		0.9		0.1
Vaccinium uliginosum	9.5	10.7	14.1	13.2	17.0	16.4	26.4
V. vitis-idaea	3.3	4.8	2.0	9.8	13.8	13.3	
SEDGE-GRASS	15.1	6.8	3.5	10.6	3.6	4.6	10.4
HERBS	0.8	2.1	2.1	9.4	2.8	4.3	1.8
*MOSS	470.0	122.4	49.6	219.5	138.8	176.3	115.2
OTHER:							
Equisetum spp.					3.3	0.4	0.1
Fungi				0.1	T		
Lycopodium spp.	1.4		0.3		2.4	0.2	

¹Number of clip-quadrats
*Includes Sphagnum sp.
T Less than 0.05 gm.

Table 6. Air-dry weights of plants removed from clip-quadrats in 1954, expressed in average grams per quadrat.

PLANTS	ED LAKE (8)'	2ND LAKE (3)'	NICHOLS LAKE (7)'	HIGH LAKE (7)'	CLARENCE LAKE (7)'	GEORGIA LAKE (2)'	MANKOMEN LAKE (4)'	SPRINGER LAKE (2)'	GROSS LAKE (3)'
LICHENS:									
Foliose	157.5	74.5	36.0	24.9	11.8	50.0	0.8	12.2	21.5
Fruticose	221.9	79.4	100.2	6.8	257.1	36.9	72.2	129.6	202.3
WOODY:									
Andromeda sp.				1.1	0.7		0.6		
Arctostaphylos alpina				2.6	9.6				
Betula nana	137.4	1.3	23.5	9.6	33.3	2.1	17.3		1.5
Cassiope spp.				0.9	15.9				
Dryas spp.				1.0					
Empetrum nigrum	42.9	90.3	77.2	84.3	62.5		24.6	1.4	
Ledum spp.	31.0	39.7	28.3	32.9	43.6	44.6	0.1	3.8	59.7
Oxycoccus microcarpus			2.3	1.7	0.9		0.1		3.3
Picea spp.	0.1								
Potentilla fruticosa			2.0	0.1			1.8		
Rosa acicularis	0.1			1.0					
Salix spp.	6.6		22.3	10.7	2.3	26.8			1.9
Spirea beauverdiana					0.8				
Vaccinium uliginosum	189.8	22.7	51.2	46.8	74.8	112.7	5.1	59.6	8.9
V. vitis-idaea	4.6	23.4	3.8	4.1	31.5	26.5	1.0	26.2	18.1
SEDGE-GRASS	12.4		15.1	64.4	8.4	94.2	119.2		98.5
HERBS	2.3	25.0	0.9	4.7	1.4	2.4	2.8	2.4	2.4
*MOSS	97.5	466.8	270.2	92.4	63.4	383.6	261.9	234.4	117.8
OTHER:									
Equisetum spp.	0.2		1.6	3.9		13.5		0.2	1.3
Fungi								1.1	0.9
Lycopodium spp.	4.1			7.7	T				

' Number of clip-quadrats
* Includes Sphagnum sp.
T Less than 0.05 gm.

RECOMMENDATIONS

Forage and range-use studies should be continued.

Prepared by:

Ronald O. Skoog
Wildlife Management Biologist

Approved by:

Robert F. Scott
Supervisor of Game Restoration

Date: May 15, 1957

Job No. 1(a)--Management Studies of Alaska Caribou
Sampling of Kill by Hunters--Nelchina Herd

Period Covered: March 31, 1956 to May 15, 1957

ABSTRACT

The 1956 hunting season proved successful for about 50 per cent of the people that hunted the Nelchina caribou. Although the hunting interest seemed somewhat subdued in comparison with past years, the kill reached expected proportions and an estimated maximum of 3,500 caribou were taken from the herd.

The kill data for the 1956 caribou hunting season for the Nelchina caribou herd can be summarized as follows:

(1) A total of 3,500 caribou were estimated to be taken.
(2) About 64 per cent of the animals killed were males.
(3) About 64 per cent of the animals killed were less than four years old, and 80 per cent less than six.

All of the raw data is filed in the Anchorage office of the Federal Aid branch.

OBJECTIVES

To obtain data relative to age and sex composition, and magnitude of the kill by hunters.

TECHNIQUES USED

Data on the caribou kill were obtained from actual tallies, from talks with residents, notably guides, and from estimates based on the availability of caribou and the number of hunters. Hunter checking-stations and field checks of hunters provided information on the sex and age of the kill, as well as data on hunters' success.

FINDINGS

Movements of the Nelchina caribou during the hunting season greatly influenced the hunters' take. In past years, the herd has frequently been accessible from the Glenn Highway near Eureka during the first of the season. By August 20 in 1956, however, most of the herd remained far to the north, inaccessible to most hunters, although scattered animals in the Little Nelchina River area provided some hunting through early September. Airplane hunters were most successful during this period, being able to reach caribou at Deadman, Nadiwen, and Coal Creek Lakes, as well as at other lakes in the upper Susitna River area. In late September a large portion of the herd moved into the Denali Highway region between the Maclaren River and the Richardson Highway. The animals were accessible to hunters through October along

both the Denali and Richardson Highways, and there the largest part of the year's kill took place. Snow closed the former highway in late October, and the animals moved away from the Richardson. In late November and early December a northward movement of caribou made some accessible along the Richardson Highway from Summit Lake to Black Rapids, but few hunters responded and the kill was slight. The season closed at the end of December with caribou still persisting along that portion of the highway.

Kill data were obtained largely from two areas: (1) the Glenn Highway, August 20 through September 3, by hunter checking-station operations; and (2) the Denali Highway, October 1 through October 31, by both checking-station and field operations. Because the structure of kill varied noticeably between the two areas, each is treated separately. The variance resulted mainly from the hunters' selectivity and from the difference in composition of the animals available.

Glenn Highway Area: At the opening of the hunting season on August 20, caribou were scattered thinly throughout the Little Nelchina River country, which lies just north of Eureka, Mile 128 on the Glenn Highway. Generally, hunting was poor, although those people with tracked vehicles or swamp buggies were able to do fairly well. To check the hunters' take, a checking-station was in operation at King Mountain Lodge, Mile 77 on the Glenn Highway, from August 20 through September 3. During that period all hunters were stopped and the following information obtained: days hunting; game hunted; game killed; sex and age of kills; weights and measurements, if possible; and, for caribou, whether successful hunters would have taken a second caribou if they had had the chance. Table 1 summarizes the information obtained during this period.

Table 1. Summary of data concerning caribou hunting, as obtained at Glenn Highway checking-station, August 20 to September 3, 1956.

Hunting Parties	509	
Caribou Hunters	1,019	
Hunters per Party	2.0	
Days Hunting	3,467	
Days per Hunter	3.4	
Caribou Taken	584	
Male	455	(77.9%)
Female	129	(22.1%)
Successful Hunters	454	
Per Cent Successful	44.6	
Hunters w/1	324	
Hunters w/2	130	
Hunters Refusing 2	135	
Hunters Wanting 2	319	
Per Cent Wanting 2	70.4	

The table shows that 45 per cent of the caribou hunters were successful. This high success figure results mainly from the fact that a vast majority of hunters used tracked vehicles or swamp buggies. Foot hunters definitely were in the minority. In fact, hunting as a whole was rather light throughout the early fall for some reason; perhaps the long season persuaded many people to wait until later. The data gathered indicate that about 70 per cent of the caribou hunters would have taken two animals had they been able. This figure shows a slight increase over the 66 per cent figure obtained in 1955. About one-third of the hunters actually did take two caribou both years. The bag limit of two resulted in about a 29 per cent increase in the kill in 1956, as compared to a 31 per cent increase in 1955.

Of the 584 caribou checked through the station, 455 (77.9 per cent) were males; this high percentage reflects both the hunters' selectivity in choosing males and the fact that males were more numerous than females in the area hunted. A total of 228 of these animals was aged by the tooth-eruption-and-wear method; Table 2 shows the distribution of the ages.

The ages indicated in Table 2 are accurate only to 3 years. So far no precise method for aging the older animals has been discovered, so they are classified according to the relative amount of wear on the teeth; the yearly designations might very well be inaccurate. Realizing the possible inaccuracies of the aging technique, the writer has attempted to find a truer picture of the age structure of the kill by using a two-year grouping of the yearly age-classes. Calves and yearlings are placed together, because these animals definitely are not preferred by most hunters, mainly because of the small size of both body and antlers. Two- and three-year-olds are lumped, again because their smaller antler size causes most trophy hunters to disregard them; also, these two year-classes still can be separated accurately. The continued two-year grouping of the older age-classes permits a direct comparison between all of the two-year groups, and also tends to smooth some of the overlap undoubtedly occurring between the artificial yearly age-classes. The figures show that about three-fourths of the animals killed in the Little Nelchina River area last year were less than six years old.

Only 8 of the 584 caribou checked through the stations were in field-dressed condition, and 1 of these 8 was weighed and measured. The high percentage of skinned and cut-up carcasses reflects the effect of the tracked-vehicle type of hunting, in which the hunters drive so far off the highway that they must take good care of their meat to prevent spoilage. As a consequence, few heads were available for aging, but hunters did bring in about 200 lower jaws for examination. They also brought in about 60 stomach samples for the food-habits study.

After 15 days of operation, the checking-station was closed on September 4 due to a lack of both game and hunters. Caribou hunting

during the rest of September was confined to the few hunters using airplanes or river-boats. By plane, hunters could reach caribou concentrations at a number of lakes in the upper Susitna River area. By river-boat, they took a few animals along the Tyone and Susitna Rivers. Not until the last week of September, however, did the caribou become readily accessible to all hunters.

Table 2. Age-distribution of caribou carcasses checked at Glenn Highway checking station, August 20 to September 3, 1956.

	Male		Female			Total	
Age	No.	%	No.	%	?	No.	%
Calf	2		2		0	4	
Yearling	25		8		1	34	
	27	18	10	16	1	38	17
2 Years	29		10		5	44	
3 Years	24		14		2	40	
	53	35	24	37	7	84	37
4 Years	8		11		1	20	
5 Years	14		9		1	24	
	22	15	20	31	2	44	19
6 Years	9		2		0	11	
7 Years	19		4		2	25	
	28	18	6	9	2	36	16
8 Years	11		1		1	13	
9 Years	4		0		0	4	
	15	10	1	2	1	17	7
10+ Years	6	4	3	5	0	9	4
Total	151	100	64	100	13	228	100

Denali Highway Area: On September 27 the vanguard of some 10,000 caribou moving eastward from the Deadman Lake area reached the hills lying just south of the Denali Highway between the Maclaren River and Paxson Lake. Many moved northward across the highway, and thus immediately became available to hunters. The word spread fast and by October 1 some 400 hunters were in the area. The bulk of the caribou settled south of the Denali Highway but bands were common along the road and in latter October also infiltrated the area along the Richardson Highway between Paxson Lake and Gakona. November hunting was poor after snow closed the Denali Highway on October 26 and the caribou moved away from the Richardson Highway. In December a northward movement made caribou available along the Richardson Highway from Summit Lake north to Black Rapids; the few hunters, however, did not make a large kill.

Thus, the biggest portion of the kill occurred between September 27 and October 31, with most of the caribou being taken during the first 10 days of this period, at a time when hunting would have been prohibited under the pattern of former seasons.

Estimates of the kill for that period vary from 2,000 to over 10,000, but an accurate one is difficult to obtain. The writer was in that area during most of the time that caribou were accessible; he recorded daily estimates of the number of cars along the roads and the number of caribou killed. These estimates were based on road checks, aerial observations, and talks with other Fish and Wildlife personnel and residents of the area. Table 3 lists these daily estimates during the September 27 to October 31 period. The total estimated kill of 1,437 is rounded off to 1,500 and to this is added a 33-1/3 per cent crippling loss, which brings the final kill figure to 2,000 animals. The estimated crippling loss perhaps is too great, but there was so much indiscriminate shooting during that hunting period that it is felt the loss was high--how high is difficult to say.

A lack of personnel prevented the operation of a checking-station except for one day, on Saturday, October 6. The same type of information was gathered from hunters as was at the Glenn Highway station earlier; Table 4 summarizes these data. The low hunters' success percentage of only 15.4 shows that caribou were becoming harder to find along the road. Although the sample was small, the fact that all of the successful hunters checked would have taken a second caribou had they had the chance seems fairly representative of the hunters' attitude during that period. The even sex-ratio of the kill recorded for that day also is fairly representative of the whole Denali kill, and reflects the more even sex-ratio occurring within caribou bands during the rut.

Data on the age and sex composition of the kill was gathered throughout October by field checks of hunters and carcasses. Of 260 caribou sexed, 151 (58.1 per cent) were males and 109 (41.9 per cent), females. The disparity from a 50:50 ratio could easily have resulted from hunters' selectivity. Several times the writer watched hunters shooting at caribou bands, and in <u>all</u> cases the largest animals (usually bulls) dropped first. It was interesting to note in the annihilation of one band of 17 animals that they were killed directly in the order of antler size, the last two killed being calves. These observations illustrate the obvious desire of many hunters to take the largest animal they can. This selectivity factor is especially operative in regard to caribou, because a hunter often has the opportunity to choose the animal he wants.

The number of carcasses aged totaled 234. Table 5 shows the distribution of these, tabulated by the two-year age groupings described earlier. The sample includes more young animals than did that obtained from the Glenn Highway area--85 per cent, versus 75, of the caribou being under six years old. This difference is understandable because a different segment of the herd was exposed to hunters in the Denali

area--a segment that included all the age and sex classes due to the mixing that takes place during the rut in early October. If the hunters' take were not biased, animals killed at that time should reflect closely the actual herd composition. Hunters' selectivity, however, is difficult to evaluate.

Table 3. Daily estimates of caribou killed in Denali Highway area during the period September 27 to October 31, 1956.

Date	Estimated Cars	Estimated Kill
September 27	25	50
28	30	60
29*	50	100
30*	150	300
October 1	100	200
2	80	80
3	80	30
4	50	20
5	90	30
6*	150	75
7*	150	50
8	60	30
9	30	20
10	30	20
11	40	40
12-18	200	150
19	30	50
20*	50	50
21*	30	30
22	20	30
23	10	5
24	10	5
25	5	2
26-31	20	10
Total	1,490	1,437
Estimated Kill		1,500
33 1/3% Crippling Loss		500
Final Kill Estimate		2,000

*Weekend Days

Table 4. Summary of data concerning caribou hunting, as obtained at Denali Highway checking-station, October 6, 1956.

Hunting Parties	143	
Caribou Hunters	299	
Hunters per Party	2.1	
Days Hunting	325	
Days per Hunter	1.1	
Caribou Taken	55	
Male	26	(47.3%)
Female	26	(47.3%)
Unknown	3	(5.4%)
Successful Hunters	46	
Per Cent Successful	15.4	
Hunters W/1	37	
Hunters W/2	9	
Hunters Refusing 2	0	
Hunters Wanting 2	46	
Per Cent Wanting 2	100	

Table 5. Age-distribution of caribou carcasses checked in Denali Highway area during October, 1956.

	Male		Female			Total	
Age	No.	%	No.	%	?	No.	%
Calf	15		2		22	39	
Yearling	21		15		1	37	
	36	30	17	19	23	76	32
2 Years	24		16		0	40	
3 Years	20		25		1	46	
	44	37	41	45	1	86	37
4 Years	12		11		0	23	
5 Years	7		5		0	12	
	19	16	16	18	0	35	15
6 Years	3		4		0	7	
7 Years	7		4		0	11	
	10	8	8	9	0	18	8
8 Years	6		4		0	10	
9 Years	4		1		0	5	
	10	8	5	6	0	15	6
10+ Years	1	1	3	3	0	4	2
Total	120	100	90	100	24	234	100

Magnitude and Structure of Entire Kill: The caribou kill for 1956 approximated that attained in 1955, and did not exceed advance estimates. The writer sets the kill at about 3,500 animals, based on direct tallies from checking-station operations and road checks and on estimates derived from miscellaneous sources. Table 6 breaks down the kill figure into its component parts. Some duplication results in that some of the guided hunters also checked their kill through the checking-station; the guide estimate hinges mainly on data supplied by the guides themselves. (The term "guide" here includes outfitters and flying service operators catering to resident hunters.) The second and last figures in the table are based on little else but the knowledge of caribou availability and of numbers of hunters in the field.

Table 6. Breakdown of 1956 caribou kill by time and area--Nelchina herd.

Period	Area	Caribou Killed
8/20-9/3	Glenn Highway	600
8/20-9/26	Vehicle Hunters, all areas	200
8/20-12/31	Guides, all areas	300
9/27-10/31	Denali Highway	2,000
11/1-12/31	Summit Lake-Black Rapids	200
8/20-12/31	Residents and Airplane Hunters, all areas	200
	Final Estimate	3,500

Calculating the final sex and age structure of the total kill requires more manipulation of figures, because the two sets of data obtained apply to different segments of the kill. The Glenn Highway harvest data, for instance, with a high percentage of males, probably can be applied only to the first three kill figures in Table 6, or to a total of 1,100 animals. The structures of these kills are most apt to resemble each other for two reasons: (1) the caribou available to vehicle hunters contained a high percentage of bulls, which would be reflected in the kill; and (2) guided hunters, being most apt to seek large animals, also would kill a high percentage of bulls. The Denali Highway data, having a more equal sex-ratio in the kill, probably can be applied with validity to the remaining kill figures, or to a total of 2,400 animals. Those kill structures probably are similar, because the hunters involved were exposed mostly to caribou concentrations containing a large number of cows in addition to bulls. These manipulations are shown in Table 7. The final results indicate that an estimated 64.4 per cent of the total 1956 caribou kill consisted of males.

A similar situation exists in calculating the age-structure of the total kill. Table 8 illustrates these calculations, the final results being represented in the third column. The figures indicate that 64 per cent of the animals killed were less than four years old and that 80 per cent were less than six.

Table 7. Computed sex-ratio of the 1956 hunters' harvest of the Nelchina caribou herd.

Sex	Glenn Hwy. Kill Data No.	%	Denali Hwy. Kill Data No.	%	Sex-Ratio of Total Kill (weighted percentages)
Male	455	77.9	151	58.1	(.314)(77.9) + (.686)(58.1)= 64.4
Female	129	22.1	109	41.9	(.314)(22.1) + (.686)(41.9)= 35.6
Total	584		260		
Total Kill	1,100		2,400		3,500

Weight Factor $\frac{1100}{3500} = .314$ $\frac{2400}{3500} = .686$

Table 8. Computed age-structure of the 1956 hunters' harvest of the Nelchina caribou herd.

Age Group	Glenn Hwy. Data Per Cent Composition Male	Female	Total	Denali Hwy. Data Per Cent Composition Male	Female	Total	Total Kill Weighted Percentages Male	Female	Total
Calf Yearling	18	16	17	30	19	32	27	18	*27
2 Years 3 Years	35	37	37	37	45	37	36	42	37
4 Years 5 Years	15	31	19	16	18	15	16	22	16
6 Years 7 Years	18	9	16	8	9	8	11	9	11
8 Years 9 Years	10	2	7	8	6	6	8	5	6
10+ Years	4	5	4	1	3	2	2	4	3
Total Kill	1,100			2,400			3,500		

Weight Factor $\frac{1100}{3500} = .314$ $\frac{2400}{3500} = .686$

*Example: (.314)(17) + (.686)(32) = 5 + 22 = 27

Note: The actual figures for the age-classes are shown in Tables 2 and 5.

RECOMMENDATIONS

Hunter kill data should be recorded annually.

Prepared by:

Ronald O. Skoog
Wildlife Management Biologist

Approved by:

Robert F. Scott
Supervisor of Game Restoration

Date: May 15, 1957

Job No. 1(b)

Management Studies of Alaska Caribou,
Sampling of Kill by Hunters - Steese-
Fortymile Herd

By Sigurd T. Olson and
Peter E. K. Shepherd

The 1956 hunting season, which ran from August 20 to December 31, was relatively unspectacular compared to the 1955 season. A total of 826 caribou were taken from the Steese Highway, the Taylor Highway, and the head of the Salcha River. The current take is only 37 percent of the 1955 take of 2325 caribou. For the second year the continuous season paid dividends since the only time the caribou were readily available was in October, when the closed season would otherwise have been in effect.

The 1956 caribou season began slowly, with little or no activity on the Steese and Fortymile Highways. Roving checks on the Steese, enforcement agents' reports, and other sources, indicated early season hunting was slow and non-productive. Aerial reconnaissance flights in August and September revealed that few caribou were available to hunters. During these flights the caribou had shown little definite movement and were dispersed over a large area encompassing the heads of the Charley, the Goodpaster, the Salcha and the Seventy Mile Rivers.

Inclement weather prevented any further aerial activity the last two weeks in September. On September 25th, Enforcement Patrolman Milsted Zahn reported that bands of from 50 to 100 caribou had begun to cross the Taylor Highway in the vicinity of American Summit; an aerial flight was made to verify this movement, by Game Management Agent Harry P. Pinkham, on September 27. He reported many bands of caribou moving north and northeast from the vicinity of the Middle Fork and Northfork of the Forty Mile River, as well as on the southside of Mt. Veta. On September 29, numerous bands of caribou were crossing along the Taylor at O'Brien Creek and Columbia Flats. In addition to this movement, even greater numbers of caribou continued to pass over the highway between the Dawson-Eagle "Y" and Polly Summit. A few small bands crossed sporadically near the Mosquitoe Fork of the Forty Mile.

Hunters were already in the vicinity during the week ending September 29-30, and consistantly took caribou between Polly Summit and the "Y". Few hunters ventured beyond these points and only an occassional caribou was taken along O'Brien Creek and Columbia Flats. Hunters from Eagle came as far as American Summit to harvest caribou. By Sunday, September 30, hunting pressure had doubled, but not nearly to the point

anticipated. The lack of hunter pressure was in part the effect of a simultaneous caribou crossing on the Denali Highway, which is considerably closer and more convenient to weekend Fairbanks and Anchorage nimrods.

A lull and shift in the migration became apparent during the mid-week between October 1-7. At this time the herds became scattered and fewer in number, with the greater portion of caribou crossing along O'Brien Creek and Columbia Flats. The following weekend (October 6-7) brought an increase in hunting pressure over that of the previous week, but with the passing of the herd, success was somewhat lowered.

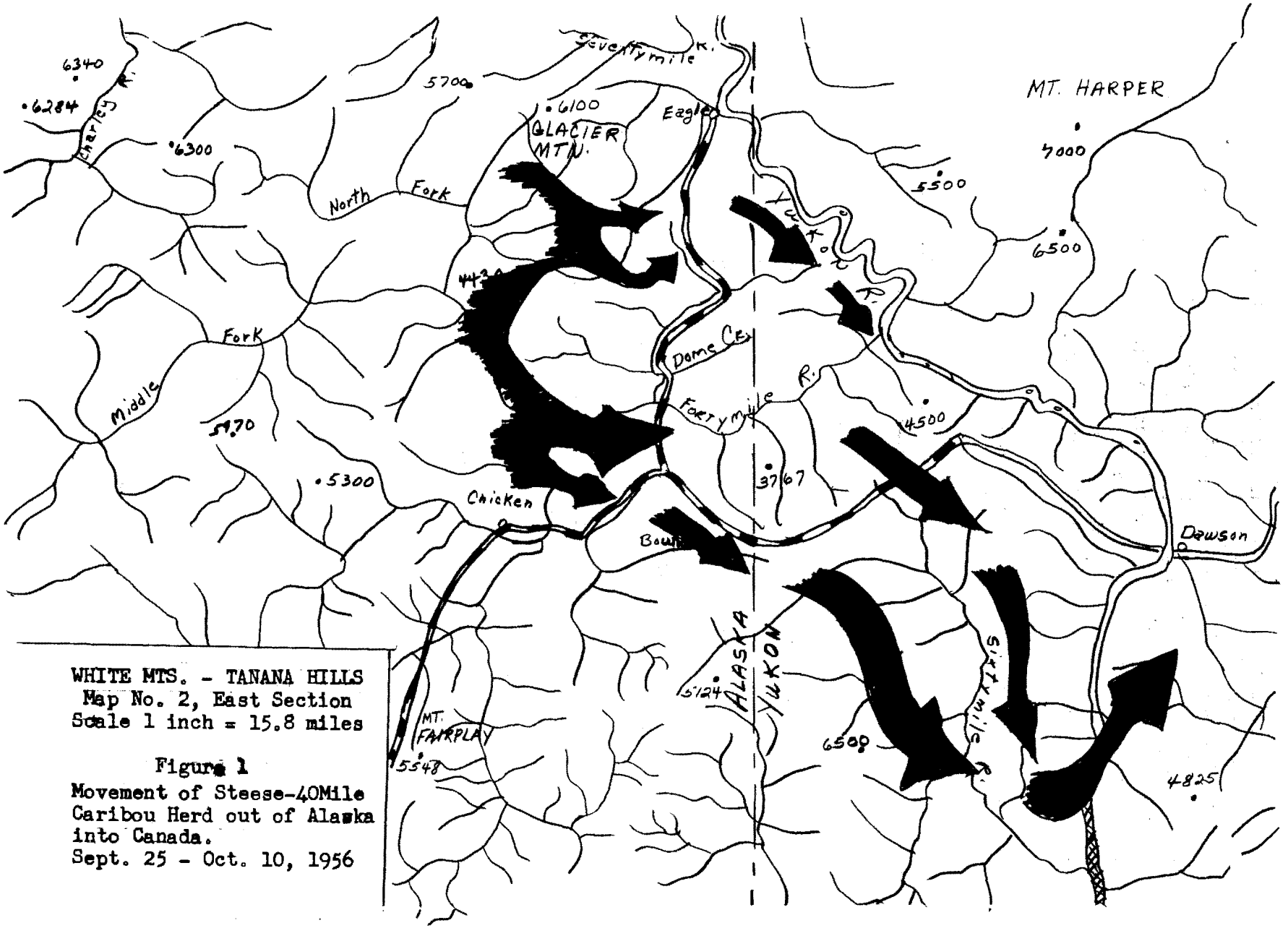
From general observations, hunter success, and aerial coverage on October 8, it was apparent that the migration was nearly over, and with little caribou sign visible west of the Taylor Highway, any chance of a continued crossing appeared slight. Most of the herd was then in Canada, and by October 15 had concentrated around Cassiar Creek and King Solomon Dome, east of the Yukon River. The movement out of the Fortymile and into Canada is traced out in Figure 1.

PROCEDURE:

Caribou were scarce on the Steese during the 1956 season, therefore, hunter bag checks consisted mainly of roving surveys conducted on week-ends. A checking station operated for two days at Fox, however it was closed down due to the lack of caribou and the close of the moose season in Unit 20. In addition to highway checks, the Chena, Salcha, and Good-paster Rivers were patrolled at intervals during the season by a biologist-aid-enforcement agent team in an effort to arrive at a better estimate of the moose kill.

In anticipation of another caribou "rush", the Mt. Fairplay checking station was readied early in September and a Jamesway building erected to house personnel. Actual operation of the station commenced September 28, 1956, and continued until October 10, 1956, when the lack of caribou, hunters, and an early closing of the Taylor Highway, made further operation impractical. Operational procedure followed that of 1955 closely except for the following modification.

In compliance with a suggestion advanced last year, mimeographed sheets outlining existing regulations, cautioning against poor and wasteful hunting practices, and requesting the hunter to observe rules of good sportsmanship were issued to all hunters enroute to the hunting area. Apparently the sportsmen took notice of them, and, as if testifying in behalf of their value, only one discarded copy was noted out of the hundreds distributed. It is felt that in view of the success of this year's pamphlet distribution, the practice should be continued.



WHITE MTS. - TANANA HILLS
Map No. 2, East Section
Scale 1 inch = 15.8 miles

Figure 1
Movement of Steese-40Mile Caribou Herd out of Alaska into Canada.
Sept. 25 - Oct. 10, 1956

The season's total take of caribou from the Steese-Fortymile caribou herd for the years 1954, 1955, and 1956 is summarized in Table 1. The usual running tally of all game checked through the station was maintained and is presented in Table 2. This tally includes Enforcement Agents' tallies, both before and after the checking station operation. Similar data from 1954-55 is also included for comparison. A similar tally for the Steese Highway is also presented in Table 2. It is based on data obtained from the checking station at Fox and from the field checks by Fairbanks Enforcement Agents and Biologist's Aids.

Table 1. Record of Caribou Killed on Steese and Taylor Highways 1954, 1955, 1956

Area	Year 1954	1955	1956
Steese Highway Known Kill	605	54	14
Steese Highway Est. Total Kill (1)	850	150	100
Taylor Highway Known Kill (1)	379	1577 (2)	607 (3)
Taylor Highway Est. Total Kill (1)	850	2175 (2)	742 (3)
Estimated total kill for Steese and Taylor Highways	1700	2325	842

1. Estimated total take includes additional kills not accounted for at checking station
2. Includes 20 percent crippling loss
3. Includes 10 percent crippling loss

Table 2. Record of Hunter Kill on the Taylor Highway 1954, 1955, 1956

Species	1954	1955	1956
Moose (Known Kill)	17	41	57
Est. Total Kill(1)	75	55	60(3)
Black Bear(2)	5	0	1
Grizzly Bear(2)	1	1	4
Ptarmigan	321	117	15
Grouse	258	93	23
Rabbit	13	127	2

Note: (1) Estimated total take includes additional kills not accounted for at the checking station.

(2) Represents all bear taken during the season.

(3) Does not include second season kill for 1956.

1954 -- 20 days checking

1955 -- 23 days checking

1956 -- 13 days checking

Table 2 continued next page

Table 2 (continued) Record of Hunter Kill on the Steese Highway 1954, 1955, 1956

Species	1954	1955	1956
Moose (Known Kill)	63	31	21
Est. Total Kill[1]	90	95	85[2]
Black Bear	4	6	14
Grizzly Bear	2	0	0
Ptarmigan	1428	325	17
Grouse	389	49	47
Rabbit	118	20	0

Note: (1) Includes additional kills not accounted for at the checking station
(2) Does not include second season

1954 -- 16 days checking

1955 -- 4 days checking

1956 -- 9 days checking

RESULTS:

For the second year, the greatest take of caribou occurred on the Taylor Highway where 88 percent of the total kill was sustained. The remaining 12 percent came from the Steese Highway and the head of the Salcha River. Caribou from the Steese were taken generally from the area near Twelve Mile Summit (Mile 84) and the Harrison Creek Road branching off from the Steese Highway at Mile 110. An estimated 20 caribou were taken above the Caribou Mines on the Salcha River by hunters who travelled in by river boat early in September. Due to the sporadic nature of the hunting on the Steese Highway, no attempt has been made to evaluate hunter success beyond the fact it was extremely low, probably five percent or less.

The 1956 caribou hunt on the Taylor Highway resulted in a total kill of 742 caribou. This figure includes an estimate of 50 caribou killed prior to September 28, the 607 kills checked through the Fairplay Station during the September 28 - October 10 crossing, an estimated 10 percent crippling loss, and an estimated 20 animals taken by Eagle residents during November and December.

Hunter Success

Hunter success in 1956 on the Taylor Highway during the caribou rush was higher than in 1955. In order to compare current data with the 1955 data, success precentages must be based on the number of hunters who shot at least one caribou rather than the number of caribou taken per hunter.

A daily summary of hunter success presented in Table 3 shows that 876 hunters took 607 caribou. Sixty-one percent of the hunters succeeded in bagging at least one caribou compared to 55 percent in 1955. The limit of two caribou in 1956, however, raised the success ratio measured in "number of caribou per man" to .69. This is a difference of 14 percent or .14 caribou over 1955. In view of the fact that caribou were readily available, it is somewhat surprising that the number of hunters taking two caribou was only 11 percent. This is considerably less than the 32 percent recorded for the Nelchina in 1955. Thus, doubling the limit resulted in increasing the take by 12 percent.

Success measured in caribou taken per man day is the same for both 1955 and 1956. Interpreted on the basis of "at least one caribou taken", hunters in 1955 faired slightly better than in 1956, averaging .46 per day.

A review of Table 4 will show that hunters from Fairbanks again dominated Taylor Highway caribou grounds with 59 percent of all sportsmen checked coming from that city or nearby towns and military bases. There

Table 3. Daily Summary of Hunter Success Statistics on the Taylor Highway
September 28 - October 10, 1956

Date	Caribou: Bulls	Caribou: Cows	Caribou: Calves	Total Caribou	No. Hunters	Hunter Days	Success (Caribou Per Man)	Success (At Least 1 caribou)	Caribou Per Man Day	No. Cars	Hunters Per Car
Sept. 28	10	2	0	12	12	61	1.0	.75	.19	6	2.0
29	49	20	0	69	51	81	1.35	.98	.85	23	2.2
30	87	57	1	145	110	134	1.3	.85	1.08	50	2.2
Oct. 1	37	29	0	66	45	55	1.4	.98	1.2	20	2.3
2	31	21	0	52	40	43	1.3	.98	1.2	18	2.2
3	29	10	0	39	64	92	.61	.47	.42	25	2.6
4	17	15	1	33	39	56	.84	.62	.58	15	2.6
5	13	17	0	30	51	75	.58	.42	.40	23	2.2
6	24	17	0	41	100	153	.41	.30	.27	40	2.5
7	45	36	1	82	267	392	.30	.36	.20	112	2.4
8	16	12	0	28	47	84	.59	.45	.33	20	2.4
9	3	5	2	10	30	63	.33	.33	.15	11	2.7
10	0	0	0	0	20	31	.00	.00	.00	7	2.9
Total 1956	361	241	5	607	876	1320	.69	.61	.46	370	2.4
1955 (10/15-30/55)	773	704	54	1534	2791	3340	.55	.55	.46	2791	2.2

Hunters Taking 0 Caribou	340	39 %
" " 1 "	465	53 %
" " 2 "	71	8 %
Total No. Hunters	876	100 %

were, however, 10 percent less Fairbanks people in the Fortymile area than in 1955. Twenty percent of the hunters came from Tok and the surrounding villages, an increase of 10 percent over 1956. The remaining hunters came from the Richardson Highway, (11%), Anchorage (9%) and Haines and Skagway (1%). The number of civilian to military hunters was nearly the same as the 1955 season (70.4 civilian, 29.6 military).

Sex and Age

One hundred and eighty-one jaws, 30 percent of the total take on the Taylor Highway, were collected. A comparison of sex and age (adult or calf) data over a three year period is shown in Table 5. Noticeable is the apparent drop in the number of calves killed, perhaps indicating a poor calf crop survival or possibly more selective hunting practices. Scant evidence in the form of limited composition counts taken during part of the 1956 migration tend to suggest the possibility of poor calf survival this season. A later count in Canada agreed with these findings, although it was not known what portion of the herd was being sampled, or if the sample was representative of the entire herd.

The percentage of bulls killed in 1956 is somewhat greater than in the two previous years. There are two factors which may have contributed to this change in the kill pattern. The first being the fact that the 1956 crossing occurred during the active rutting period which made bulls more available than in previous years. The larger bulls seem to straggle behind the bulk of the herd after the peak of the rut is over. In 1955, the crossing was two weeks later than 1956, and much of the kill had occurred by the time many of the large bulls began to show up. Secondly, the caribou were available on the very open summit areas above timber line, affording hunters more selective shooting.

Highway Crossing

The pattern of crossing differed considerably in 1956 as compared to 1955 in that the crossing was restricted largely to the area between Mile 85 and 150. In 1955, the crossing extended from Mile 20 to 110 for the most part.

Seventy-three percent of the caribou were taken along a 20 mile stretch of road, beginning above Jack Wade (Mile 85) and continuing as far as Polly Summit (Mile 110). Had the hunters been more venturesome, they could have profited by driving a few more miles to O'Brien Creek and Columbia Flats. Thousands of caribou crossed these points without a shot being fired at them. It was not until the last few days of the crossing that hunters, other than local people, harvested some animals in these areas from the remnants of the herd. The only other area of

Table 4. Residence of Hunters Passing Through Checking Station at Mt. Fairplay - 1956

Area	No.		Percent
Fairbanks	244)		
College	28)		
Ladd	122)	460	59%
Eielson	56)		
North Pole	10)		
Richardson Highway	13)		
Big Delta	37)	84	11%
Fort Greely	34)		
Anchorage	49)		
Valdez	4)		
Homer	3)	69	9%
Ft. Richardson	9)		
Kenai	4)		
Tok	31)		
Tanacross	31)		
Northway	42)	153	20%
Tetlin	21)		
Dot Lake	28)		
Skagway	4)	13	1%
Haines	9)		
TOTAL	779		100%
Civilian	550		70%
Military	229		30%

Table 5. Comparison of Sex and Age from Checking Station Data of Caribou Take from the Steese-Fortymile Herd 1954, 1955, 1956

Sex and Age	1954 No.	1954 %	1955 No.	1955 %	1956 No.	1956 %
Calves	55	5.5	61	3.7	5	.8
Cows	467	47.5	747	46.0	241	39.7
Bulls	462	47.0	816	50.3	361	59.5
Total	984	100.0	1624	100.0	607	100.0
Ratio	Bull : Cow 98 : 100		Bull : Cow 109 : 100		Bull : Cow 150 : 100	

any importance was American Summit (Mile 135-140) where 16.9 percent were taken. Figure 2 illustrates the number of caribou taken along 10 mile segments of the Taylor Highway.

Crippling Losses

The estimated crippling loss (10 percent including abandoned kills) in 1956 was only one-half as great as in 1955. The crippling loss was based on the known number of abandoned kills in relation to the total take between Jack Wade, the "Y", Boundary and Polly Creek Summit. Seventy-four percent or 450 of the total take of 607 caribou (taken during the "rush") were taken in the afore mentioned area. Hunter reports and searches by Fish and Wildlife personnel showed 22 caribou carcasses left by hunters either as cripples or abandoned in this area. This amounts to five percent of the total kill. It is assumed, however, that at least as many more were crippled and died later in areas not accessible to search. Thus, the total loss is estimated to be ten percent. The crippling loss is negligible when caribou are scarce. An appreciable loss only occurs when conditions such as those created by "rush" conditions exist.

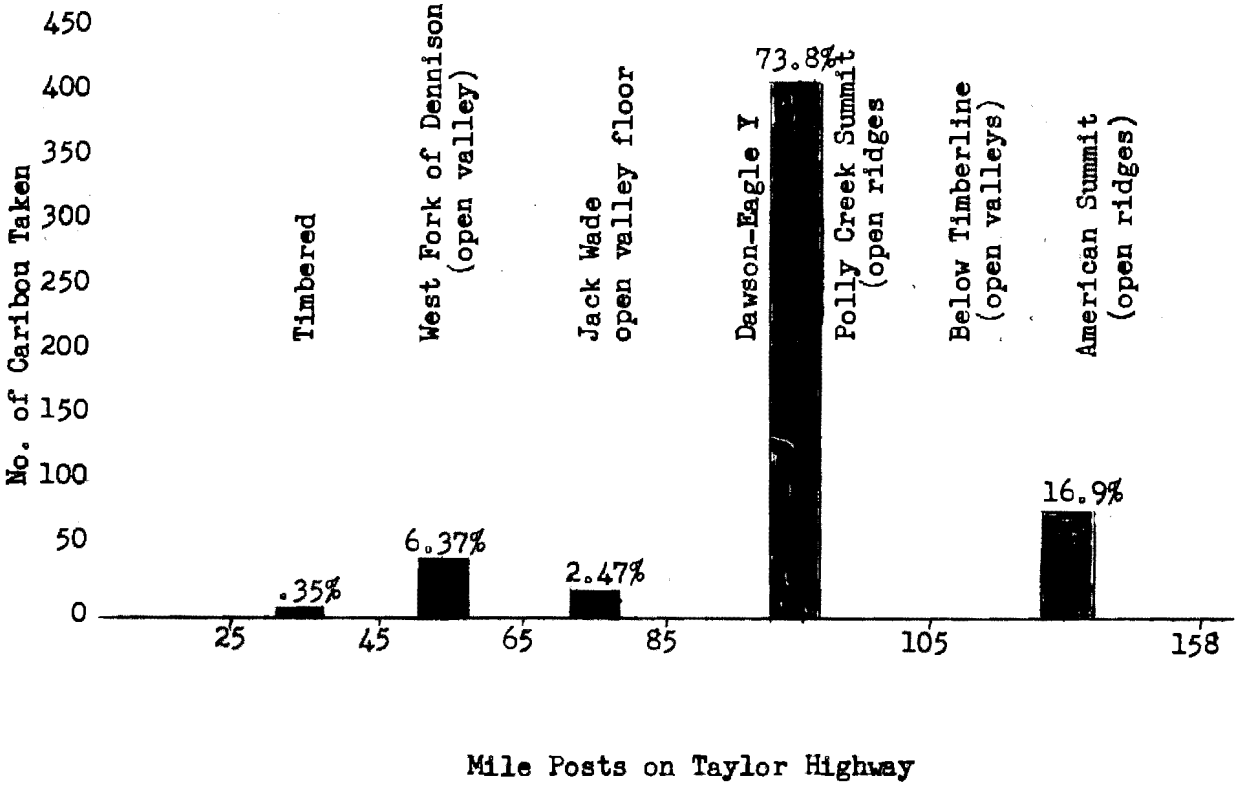
The reduced crippling loss in 1956 is believed to be the result of several factors: the information sheets described earlier undoubtedly had their effect; the fact that most of the hunting occurred in open

alpine areas where visability was good, afforded optimum shooting conditions, and the intense patrol activities of Enforcement Agents in the heavily hunted areas.

Biological Data

One hundred and eighty-one jaws were collected, 226 caribou aged by inspection, and 607 caribou were sexed as they were checked through the Fairplay Station. Complete measurements and weights were obtained from 35 carcasses. Stomach samples were again collected for Alan Courtright of the University of Alaska.

Figure 2. Distribution of 565 caribou kills along 20 mile segments of the Taylor and Eagle Highways -- September 28 - October 10, 1956.



DISCUSSION

Past experience and information collected at checking stations has indicated that the potential harvest of caribou in the Steese-Fortymile herd at its present population level was not being realized. Accordingly, the season was lengthened and the limit doubled to increase the take. Despite these actions, the 1956 take was only 37 percent of the record take in 1955 of 2325 caribou. Doubling the limit increased the current take by only 11 percent over what it would have been, had the limit been one. The increased length of season was to no avail since an early blizzard closed the Fortymile on October 10, two and one half months before the season was over.

There seems to be little more that can be done to increase the harvest of caribou in this area. They are usually available only during very short periods when they move near or across either the Steese or Taylor Highways. If these periods happen to coincide with periods when caribou are available elsewhere such as the Nelchina-Paxson areas, the kill is further reduced.

The size of the annual kill under present conditions appears to be largely a matter of circumstance. It is believed that the current regulations are adequate to supply the hunter with sufficient caribou if the local circumstances are favorable. Barring a radical population change, due to a change in migration pattern, failure of a succession of calf crops or extensive predation, it is doubtful that any management technique beyond those already being used will materially affect the Steese-Fortymile caribou herd.

Hunter Success -- Moose

Hunter success on the Steese and Taylor Highways was similar to preceding seasons. The known take on the Taylor represents practically the entire moose harvest for the season for that area. It appears that the take is up slightly from 1955. Although the kill on the Steese is more subject to an estimate, there was no indication that hunter success raised significantly from previous years. Using these two areas as an index to the moose hunting elsewhere out of Fairbanks and vicinity, it appears that hunter success has remained quite stable. A detailed summary of the moose kill is presented in Table 6. Note that the second season kill is almost negligible.

SUMMARY

1. Total caribou kill from Steese-Fortymile herd during 1956 was 862.

Table 6. Moose Kill - 1954, 1955, 1956 - Steese and Taylor Highways

Area	Take	First Season			Second Season			Total		
		1954	1955	1956	1954	1955	1956	1954	1955	1956
Steese & Elliott Highway	Known Kill	63	27	21	0	4	0	63	90	85
	Est. Kill(1)	22	63	64	5	1	5	27	5	5
	Total	85	90	85	5	5	5	90	95	90
Taylor Highway	Known Kill	17	37	57	0	4	3	17	41	60
	Est. Kill	53	13	3	5	1	7	58	14	7
	Total	70	50	60	5	5	10	75	55	67

(1) Includes known kill based on estimates by FWS personnel in the field during the hunting season.

2. Eighty-eight percent of kill made during September 25-October 10 crossing of Taylor Highway. Twelve percent of kill made on Steese and head of Salcha River.

3. Fifty-three percent of the hunters killed one caribou. Eight percent killed two caribou.

4. Two limit increased take by only 12 percent over one limit.

5. Composition of take: Bulls, 59.5%; cows, 39.7%; and calves, 8%.

6. Fifty-nine percent of hunters were from the Fairbanks area, twenty percent from the Tok area, eleven percent from the Richardson Highway, nine percent from the Anchorage area, and 1 percent from the Haines-Skagway area.

7. Hunters 70 percent civilian, 30 percent military.

8. Main caribou producing areas were Mile 85 to 110 (Jack Wade to Polly Creek Summit), and American Summit. Ninety percent of the caribou taken came from these two areas.

9. Crippling loss dropped to 10 percent.

10. Caribou kill still far below allowable take.

11. Moose kill for Steese and Taylor same as previous years.

Job No. 2(a)--Management Studies of Alaska Caribou
Movements, Distributions, and Numbers--Nelchina Herd

Period Covered: March 31, 1956 to May 15, 1957

ABSTRACT

Movements by the Nelchina caribou during the past year were unprecedented in the recorded history of the herd. They were somewhat reminiscent of the behavior of the Steese-Fortymile herd in 1954, when that herd moved continually from spring to fall, making two and one-half round trips to Canada. The two northward movements of the Nelchina herd through Isabel Pass gave rise to the thought that the animals were headed for a new range. How many animals actually did stay north of the Alaska Range, if any, is unknown, but periodic aerial coverage failed to reveal any major desertion.

The westward movement to Cantwell is equally perplexing. Supposedly that is the area through which members of the Mt. McKinley Park herd passed in the early 1930's to establish the present Nelchina herd. As far as is known, no animals in the Cantwell group crossed the railroad to the west.

Wildlife managers have long thought that perhaps the Nelchina herd is becoming too large for its range. At present the range requirements, both for food and for social stability, are unknown, but the restless movements of the animals last year tend to hint that something is amiss. Certainly the herd will bear close watching during the near future. The data on movements used for this report are filed in the Anchorage office of the Federal Aid branch.

OBJECTIVES

To record seasonal distribution and patterns of movement of the Nelchina herd, and to make estimates of total numbers when possible.

TECHNIQUES USED

Unprecedented movements of the Nelchina caribou herd during 1956 caused some concern. The herd seemed somewhat restless throughout the year, and during December and January, 1956-57, many animals moved into areas on the northern fringe of the range that had not seen caribou in any numbers for many years. Most of the animals returned however, although a few bands may have passed to the north side of the Alaska Range. Some evidence exists that a westward departure by a few animals may have taken place also. All major movements, however, were traced accurately by use of the airplane, and the locations of the major portions of the herd were known throughout the year.

FINDINGS

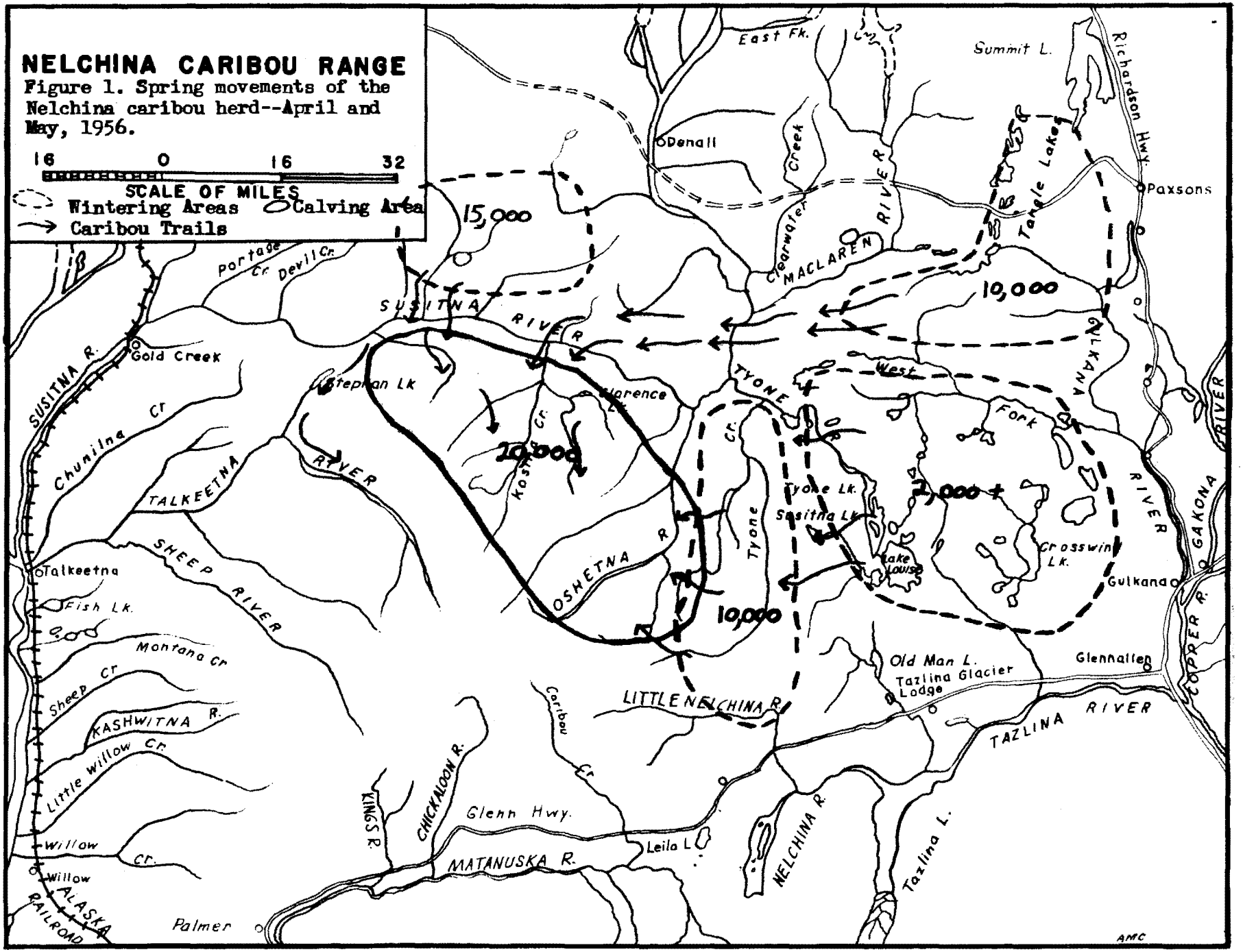
The discussion below traces the herd's movements through the spring, summer, fall, and winter of the past year.

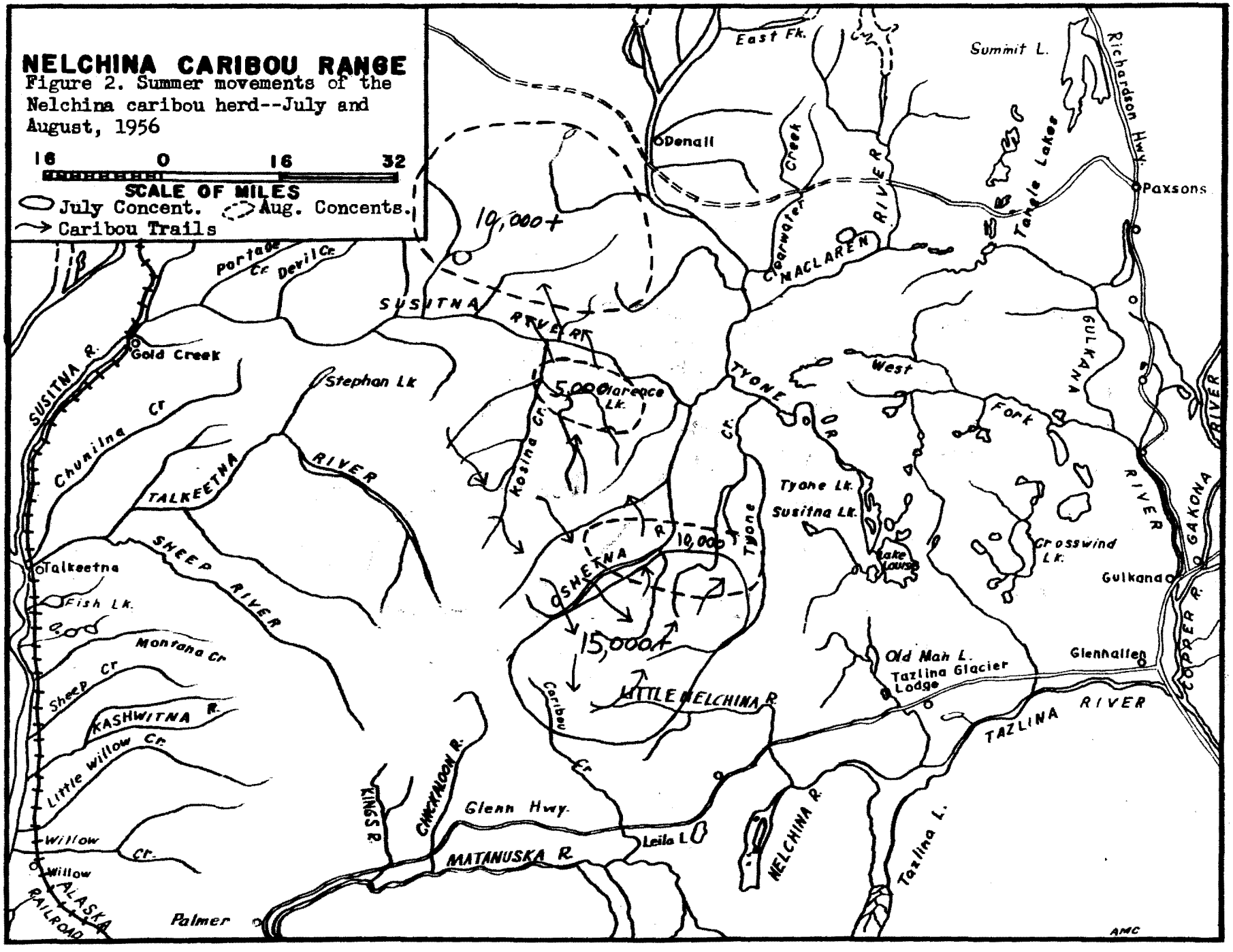
Spring: In early March, 1956, four main concentrations of caribou occurred: (1) about 15,000 near Deadman Lake; (2) about 10,000 on the ridges lying between Monsoon, Tangle, Summit, and Paxson Lakes; (3) over 2,000 scattered on the Lake Louise flats; and (4) some 10,000 scattered over the hills along Tyone Creek and the Little Nelchina River. During April and early May a large portion of these animals funneled westward and southward into the region extending from Fog Lakes to the Little Nelchina River. Those animals consisted mostly of the calving groups, most of the bulls remaining in or near the aforementioned wintering grounds. Calving thus took place over a wide area and marked the first "abnormal" behavior of the herd in 1956; formerly calving has been concentrated in a relatively small area at the head of Tyone Creek. Figure 1 shows these spring movements and outlines the calving area, which contained some 20,000 caribou in early June. Several hundred caribou settled along the Talkeetna River also, and a fair number remained north of the Susitna River.

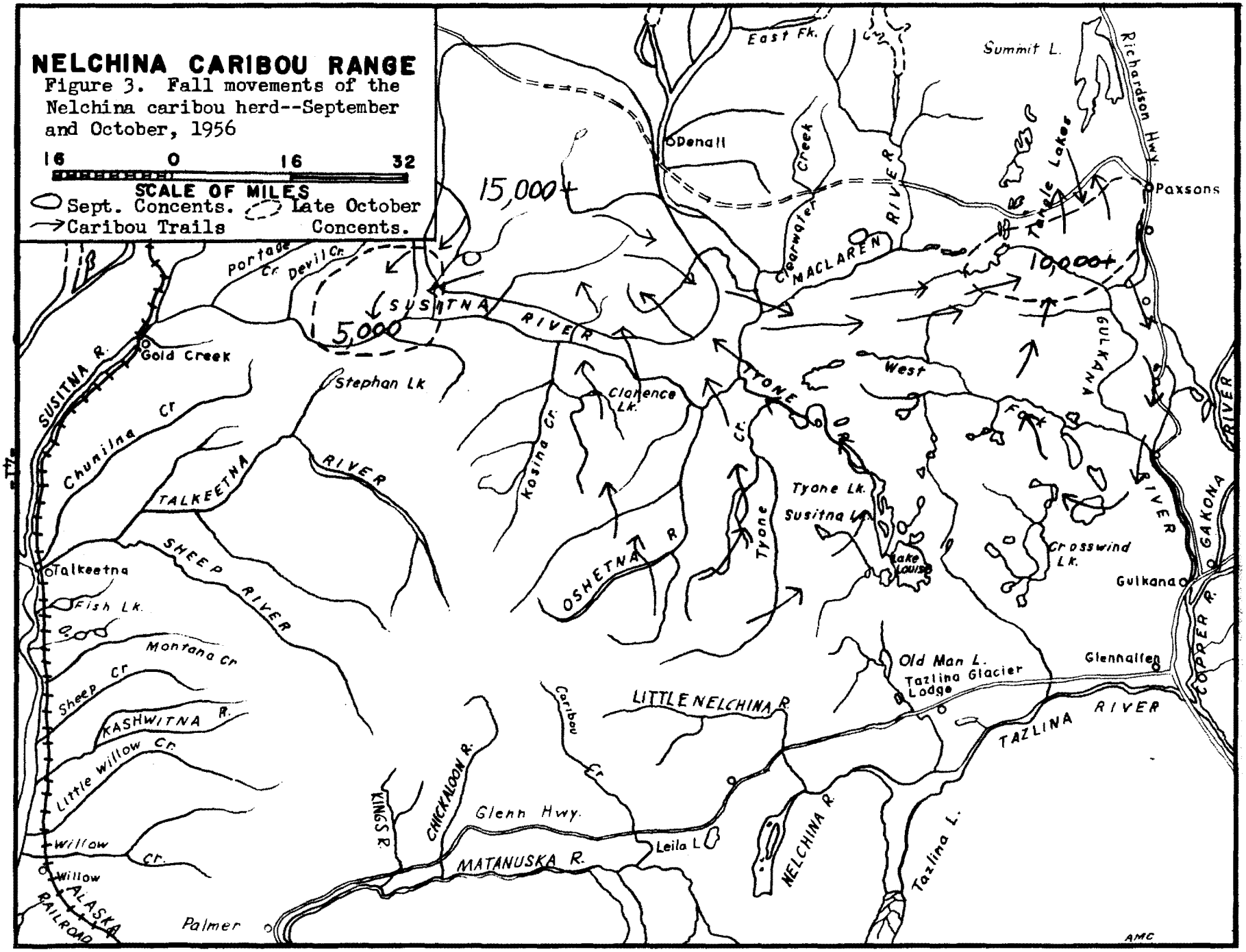
Summer: The post-calving movement took place in late June and early July. The calving groups assembled and moved south and southeast into the area bounded by the upper portions of the Little Nelchina River, Oshetna River, and Tyone Creek and by July 19 over 15,000 animals had gathered there, including many bulls. In late July a large portion of these animals moved northward to Clarence Lake, and later many crossed the Susitna River to Deadman and Nadiwen Lakes. At the end of August three known concentrations occurred: about 10,000 scattered over the hills between Black River and Tyone Creek, about 5,000 near Clarence Lake, and over 10,000 in the Deadman-Nadiwen Lakes area. Scattered groups of caribou, mostly bulls, occurred along the Denali Highway, and in the Nelchina country just north of the Glenn Highway. Figure 2 traces their summer movements through August.

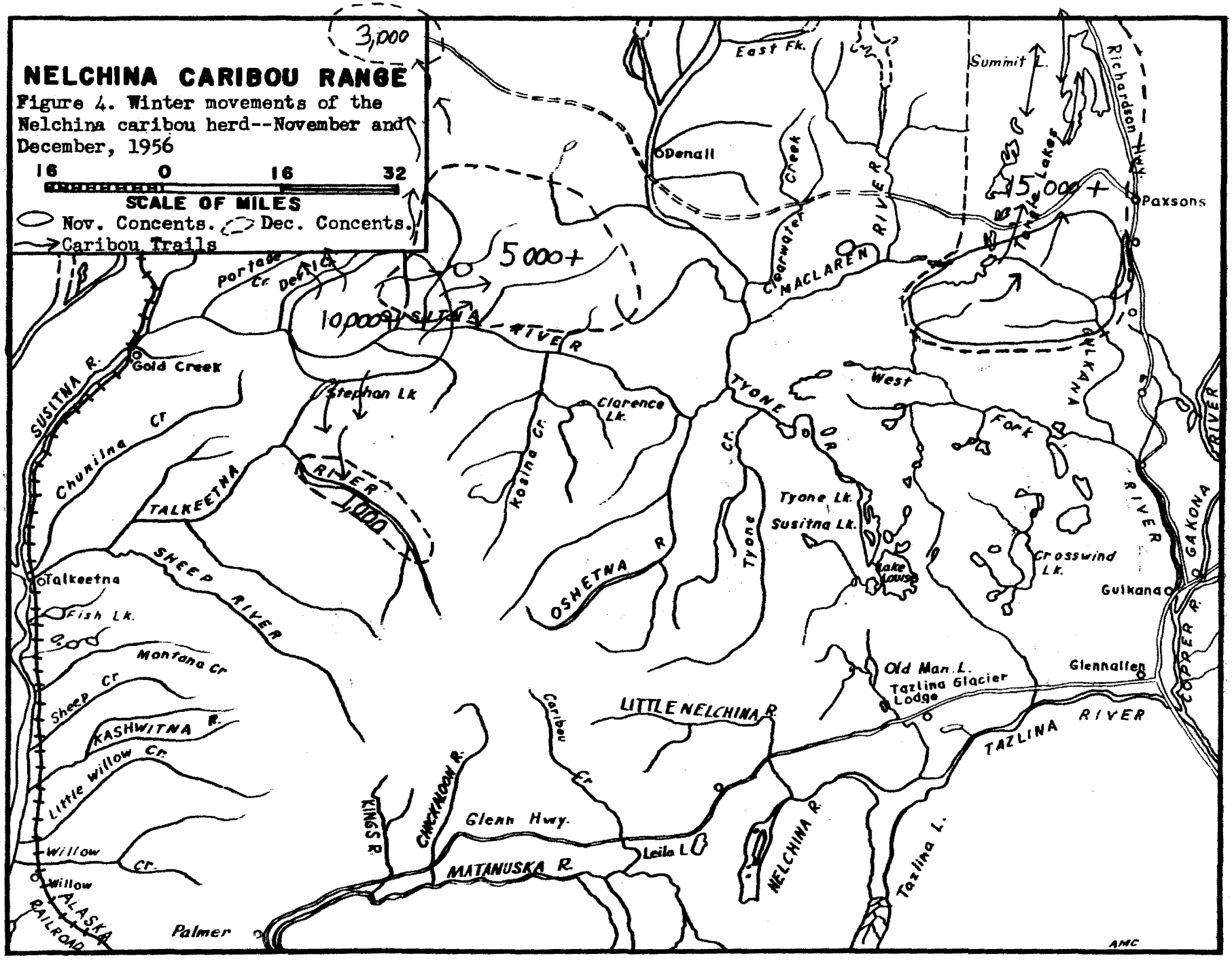
A few reports indicate that some animals may have moved off the range to the westward. On June 18, 1956, Capt. Lewis E. Yearout of the Air Force reported seeing 100-200 caribou along the east side of the railroad between Windy Pass and Talkeetna. Later an unidentified railroad employee reported seeing several hundred caribou in June cross the railroad near Chulitna and head southwestward down the Chulitna River.

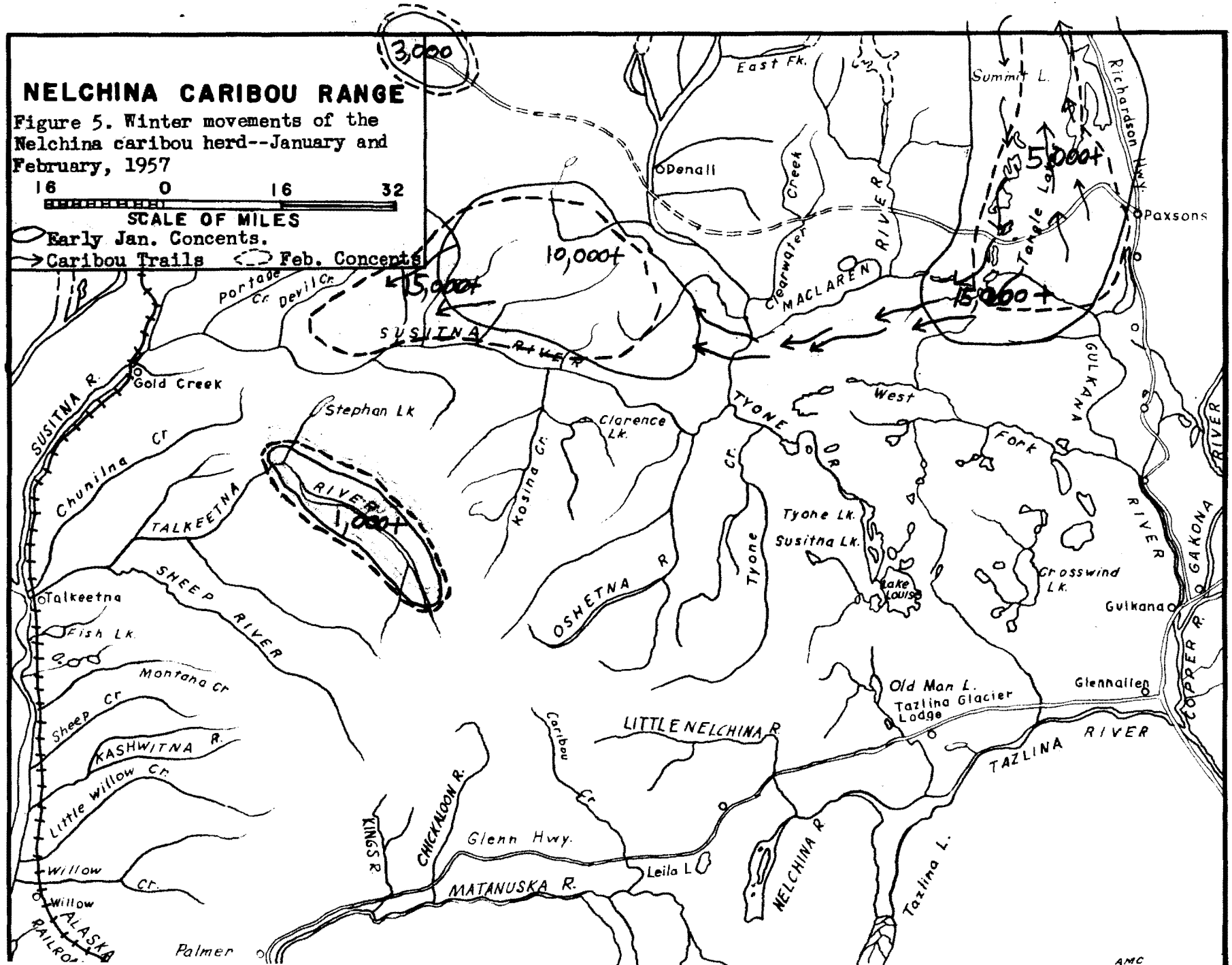
Fall: Early September found most of the caribou out of the reach of most hunters. During the middle of the month those animals still remaining to the south moved northward across the Susitna River into the Deadman Lake-Monahan Flat area, bringing that concentration to over 15,000 caribou, probably closer to 30,000. The last week in September, however, about half of this group moved eastward en masse and settled in the hills just west of Paxson Lake and south of the Denali Highway. Some animals passed to the north across the highway.


NELCHINA CARIBOU RANGE
Figure 1. Spring movements of the Nelchina caribou herd--April and May, 1956.
16 0 16 32
SCALE OF MILES
Wintering Areas
Calving Area
Caribou Trails
15,000
10,000
10,000
2,000+
10,000
East Fk.
Summit L.
Richardson Hwy.
Denali
Creek
Paxsons
Tangle Lakes
Clearwater
MACLAREN RIVER
Portage Cr
Devil Cr.
SUSITNA RIVER
SUSITNA R.
Gold Creek
Stephan Lk
Clarence
Chunilna Cr
TALKEETNA RIVER
Kosina Cr.
TYONE Cr.
West Fork
GULKANA RIVER
Tyone Lk.
Susitna Lk.
Lake Louise
Crosswind Lk.
Gulkana
COPPER R.
GAKONA RIVER
Talkeetna
SHEEP RIVER
OSHETNA R.
Tyone
Fish Lk.
Montana Cr
Sheep Cr
KASHWITNA R.
Little Willow Cr.
Willow Cr.
Willow
ALASKA RAILROAD
Palmer
LITTLE NELCHINA R.
Old Man L.
Tazlina Glacier Lodge
Glennallen
TAZLINA RIVER
Caribou Cr.
KING'S R.
CHICKALOON R.
Glenn Hwy.
Leila L.
MATANUSKA R.
NELCHINA R.
Tazlina L.
AMC


NELCHINA CARIBOU RANGE
Figure 2. Summer movements of the Nelchina caribou herd--July and August, 1956
16 0 16 32
SCALE OF MILES
July Concent.
Aug. Concents.
Caribou Trails
East Fk.
Summit L.
Richardson Hwy.
Denali
Clearwater Creek
MACLAREN RIVER
Tangle Lakes
Paxsons
10,000+
Portage Cr
Devil Cr.
SUSITNA RIVER
SUSITNA R.
Gold Creek
Stephan Lk
Clarence Lk.
5,000
Kosina Cr.
Chunilna Cr
TALKEETNA RIVER
TYONE R.
Tyone Cr.
West Fork GULKANA RIVER
Tyone Lk.
Susitna Lk.
Lake Louise
Crosswind Lk.
GAKONA RIVER
COPPER R.
Gulkana
Talkeetna
Fish Lk.
SHEEP RIVER
Montana Cr
Sheep Cr
KASHWITNA R.
Little willow Cr.
Willow Cr.
Willow
ALASKA RAILROAD
Palmer
10,000+
OSHETNA R.
15,000+
Caribou Cr.
LITTLE NELCHINA R.
Old Mah L.
Tazlina Glacier Lodge
Glennallen
TAZLINA RIVER
KING R.
CHICKALOON R.
Glenn Hwy.
Leila L.
MATANUSKA R.
NELCHINA R.
Tazlina L.
AMC


NELCHINA CARIBOU RANGE
Figure 3. Fall movements of the Nelchina caribou herd--September and October, 1956
16 0 16 32
SCALE OF MILES
Sept. Concents.
Late October Concents.
Caribou Trails
15,000+
5,000
10,000+
East Fk.
Summit L.
Richardson Hwy.
Denali
Creek
Clearwater
MACLAREN RIVER
Tangle Lakes
Paxsons
Portage Cr
Devil Cr.
SUSITNA RIVER
SUSITNA R.
Gold Creek
Stephan Lk
Clarence Lk.
Kosina Cr.
TYONE Cr.
West Fk
GULKANA
Chunilna Cr
TALKEETNA RIVER
Tyone Lk.
Susitna Lk.
Crosswind Lk.
GAKONA RIVER
Talkeetna
SHEEP RIVER
OSHETNA R
Tyone
Lake Louise
Gulkana
Fish Lk.
Montana Cr
Sheep Cr
Old Man L.
Tazlina Glacier Lodge
Glennallen
COPPER R.
KASHWITNA R.
Little willow Cr.
LITTLE NELCHINA R
Caribou Cr.
TAZLINA RIVER
KINGS R.
CHICKALOON R.
Glenn Hwy.
Willow Cr.
Willow
Leila L
NELCHINA R
Tazlina L.
ALASKA RAILROAD
MATANUSKA R.
Palmer
AMC


NELCHINA CARIBOU RANGE
Figure 4. Winter movements of the Nelchina caribou herd--November and December, 1956
16 0 16 32
SCALE OF MILES
Nov. Concents.
Dec. Concents.
Caribou Trails
3,000
5,000+
10,000+
1,000
15,000+
Summit L.
East Fk.
Richardson Hwy
Paxsons
Denali
Clearwater Creek
MACLAREN RIVER
Portage Cr.
Devil Cr.
SUSITNA RIVER
Gold Creek
SUSITNA R.
Stephan Lk
Clarence Lk.
Kosina Cr.
Chunilna Cr
TALKEETNA RIVER
TALKEETNA
SHEEP RIVER
OSHETNA R
TYONE R
TYONE Cr.
West Fork
GAKONA RIVER
Tyone Lk.
Susitna Lk.
Lake Louise
Crosswind Lk.
Gulkana
COPPER R.
Talkeetna
Fish Lk.
Montana Cr
Sheep Cr
KASHWITNA R.
Little willow Cr.
Willow Cr.
Willow
ALASKA RAILROAD
Palmer
KINGS R.
CHICKALOON R.
Glenn Hwy.
MATANUSKA R.
Caribou Cr.
LITTLE NELCHINA R.
Leila L.
NELCHINA R.
Old Man L.
Tazlina Glacier Lodge
Glennallen
TAZLINA RIVER
Tazlina L.
AMC


NELCHINA CARIBOU RANGE
Figure 5. Winter movements of the Nelchina caribou herd--January and February, 1957
16 0 16 32
SCALE OF MILES
Early Jan. Concents.
Caribou Trails
Feb. Concepts
3,000
10,000+
15,000+
1,000+
5,000+
15,000+
East Fk.
Summit L.
Richardson Hwy.
Denali
Creek
Clearwater
MACLAREN RIVER
Tangle Lakes
Paxsons
Portage Cr
Devil Cr
SUSITNA
SUSITNA R.
Gold Creek
Stephan Lk
Chunilna Cr
TALKEETNA
RIVER
Kosina Cr.
Clarence Lk.
TYONE R.
West
Fork
GULKANA
COPPER RIVER
GAKONA
Talkeetna
Fish Lk.
SHEEP RIVER
OSHETNA R
Tyone
Tyone Lk.
Susitna Lk.
Lake Louise
Crosswind Lk.
Gulkana
Montana Cr
Sheep Cr
KASHWITNA R.
Little Willow Cr.
Old Man L.
Tazlina Glacier Lodge
Glennallen
LITTLE NELCHINA R
Caribou Cr
TAZLINA RIVER
KINGS R.
CHICKALOON R.
Glenn Hwy.
Leila L
MATANUSKA R.
NELCHINA R
Tazlina L.
Willow
Willow Cr.
ALASKA RAILROAD
Palmer
AMC

There, hunters finally were able to reach the caribou, and they killed animals throughout October. Some movement took place in late October when many animals from the Paxson area swung southward along the Richardson Highway, then westward past Ewan and Crosswind Lakes, and finally returned northward via the upper West Fork of the Gulkana River. Meanwhile, large numbers in the Deadman Lake area moved southward to the Susitna River, between Devil Creek and Fog Lakes. Figure 3 shows these fall movements and areas of concentration. Again the caribou behavior was somewhat "abnormal", because the Paxson Lake area had not been visited by so many caribou for many years.

Winter: During November the caribou remained rather static within the two widely separated regions: Devil Creek, with over 10,000 animals, and Paxson, some 80 miles to the east, with over 15,000. In early December the eastern group began a northward movement through Isabel Pass, a movement that extended as far as Black Rapids Glacier. Such a movement is unrecorded in the recent history of the Nelchina herd. By the end of December, however, most of the animals had returned southward. Meanwhile the western group had split: over 1,000 had moved southward and had settled along the upper Talkeetna River; another 3,000 or so had moved northwestward and had settled in the hills just east of Cantwell; the remaining animals had spread out over the Devil Creek-Deadman Lake area. Figure 4 shows these movements.

In early January many of the eastern group (Paxson-Tangle Lakes area) again moved northward through Isabel Pass. At Black Rapids Glacier, however, most of them passed westward up the glacier and then southward back to the Tangle Lakes region. Over 15,000 animals were tallied in the region at that time. During latter January all but about 5,000 moved westward just south of the Maclaren River and passed into the Deadman Lake region. After the latter movement the caribou settled down for the remaining portion of the winter, and the following wintering distribution was evident: about 3,000 near Cantwell; over 15,000 in the Devil Creek-Deadman Lake region; over 1,000 along the Talkeetna River; and over 5,000 in the Tangle Lakes-Summit Lake area. Figure 5 shows the movements and concentration areas.

RECOMMENDATIONS

Movements of the Nelchina herd should be watched closely in the future.

Prepared by:

Ronald O. Skoog
Wildlife Management Biologist

Approved by:

Robert F. Scott
Supervisor of Game Restoration

Date: May 15, 1957

Work Plan B Job No. 2-b

Management Studies of Alaska Caribou - Movements, Distribution and Numbers - Steese Fortymile Herd

By Sigurd T. Olson

Movements and Distribution

Movements of the Steese-Fortymile caribou were traced largely by periodic aerial reconnaissance flights by Fish and Wildlife Service personnel from the Fairbanks and Tok stations. A total of 56 hours of flying time was devoted to this project during the year. In addition, reports from the U. S. Geological Survey, University of Alaska, commercial pilots, local residents and the Canadian Wildlife Service served to fill in gaps and substantiate our own information.

The Steese-Fortymile caribou herd movements during 1956 were relatively well defined and somewhat less erratic than in previous years. From an overall point of view, the entire pattern conformed more closely to the seasonal movements generally attributed to caribou, i.e. north in summer and south in the winter, than in previous years.

By late winter, most of the herd had filtered back from Canada and were scattered throughout the Seventy Mile and Charley River drainages. Scattered bands were also observed on the ridge and hills at heads of the Goodpaster and North Fork of the Fortymile. No caribou wintered north or west of these areas or in the lower drainages of the Fortymile River. By late April, a gradual northwest drift was becoming apparent as evidenced by the appearance of approximately 1,000 caribou on the ridge above Circle Hot Springs and scattered small bands over the lower Birch Creek drainage. These were the vanguard of a decided movement northwestward out of the Seventymile Valley towards Twin Mountain early in May. At the same time, caribou began moving north from the heads of the Goodpaster, Salcha, Charley and Chena Rivers. Within two weeks, a definite migration of cows, yearlings and a very few young bulls, was crossing the Steese Highway between Twelve Mile and Eagle Summit enroute to the calving grounds in the White Mountains. The movement stagnated on May 19 as calving activity increased. By this time, approximately 25,000 caribou (based on highway counts obtained later) were concentrated along the divide between Beaver Creek and Preacher Creek. Not all the caribou had crossed the Steese, however, and aerial surveys during the calving period, May 20 to June 7, indicated that several thousand caribou were spread out over the Birch Creek-Salcha River drainages. These caribou also were largely cows and yearlings, however occassional groups of adult bulls were observed.

After calving, the caribou northwest of the Steese moved back across the highway at Eagle Summit. Counts (see section on "Highway Crossing") indicated that not less than 30,000 animals were involved. The caribou south of the highway joined the movement and by July the whole herd was spread out across the country generally south of the Salcha and Charley Rivers. U. S. Geological Survey parties and ground survey parties headed by Wilbur J. Libby of the University of Alaska, working throughout this area during August, reported numerous small groups of caribou distributed over the headwaters of the Charley, Salcha and Goodpaster Rivers. No caribou were noted in the Fortymile area however. By late September, however, many thousands of caribou had congregated in the Fortymile and were beginning to cross the Taylor Highway at American Summit. This continued for nearly two weeks, most of the caribou crossing steadily between the Dawson Eagle "Y" and American Summit. Lesser numbers crossed between Chicken and the "Y" at the same time. After leaving the highway, the movement paralleled the Yukon River and proceeded down the Sixtymile River valley into Canada. During December, a large share of them crossed the Yukon and moved into the foothills of the Ogilvie Mountains east of Dawson moving as far north as the Chindandu River and Seela Pass, according to a report from William Fuller of the Canadian Wildlife Service.

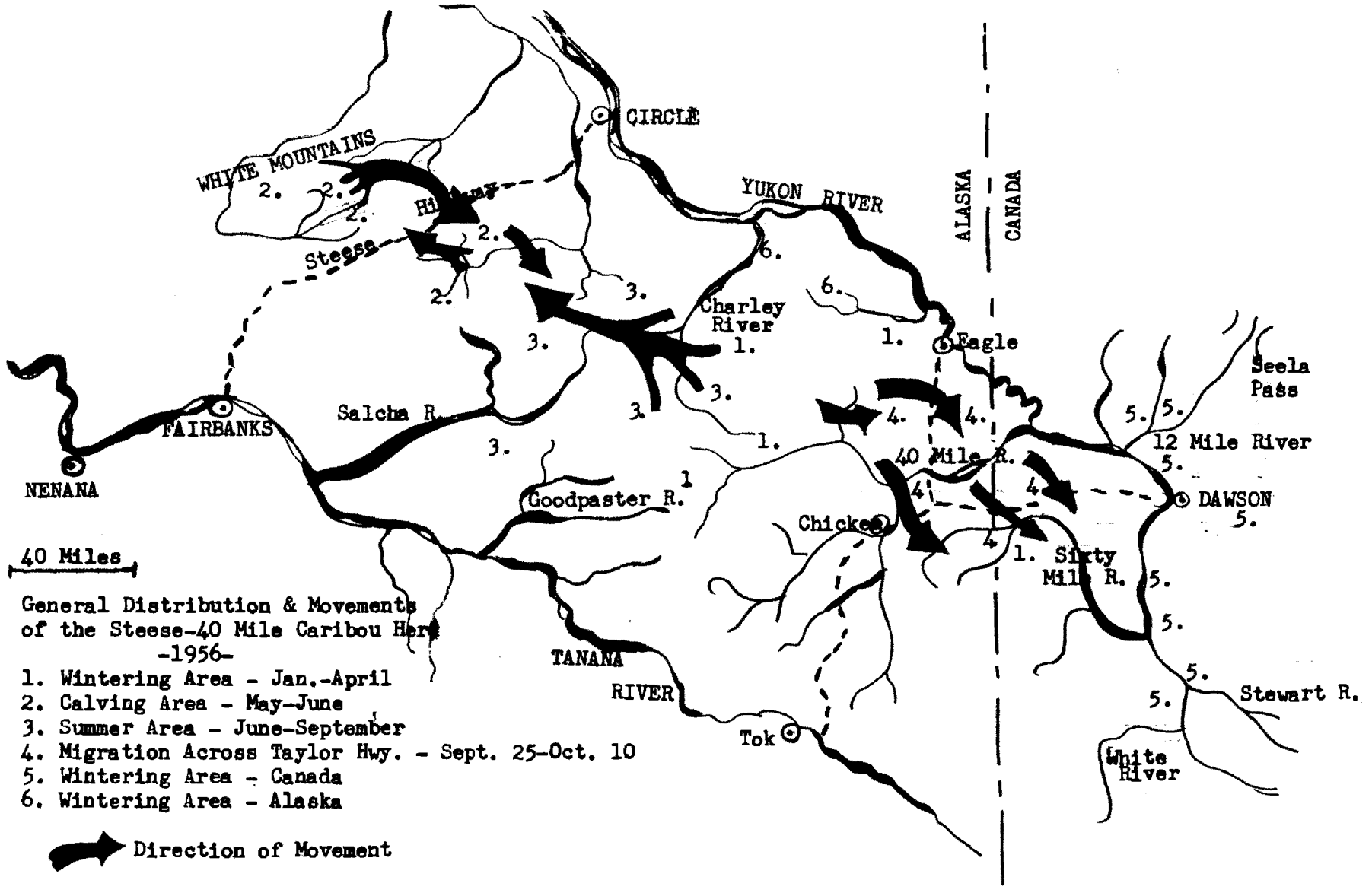
The entire herd, however, did not go into Canada. An estimated 2,000 moved into the Seventymile River - Charley River area east of Twin Mountain and remained there through December. No other caribou, however, were evident elsewhere in the Steese-Fortymile region.

It is very evident that migration routes vary from year to year without apparent cause. It is quite possible in view of the latest movements that a considerable portion of the Steese herd could be lost if they do not recross the Yukon. Portions of the Porcupine caribou have wintered in past years (see section on "Porcupine Caribou") on the Blackstone River which is a relatively short distance north. Should the caribou in question move north instead of retracing their steps, an acute shortage of caribou in the Steese-Fortymile region could result. Figure 1 portrays the general distribution and movements of the herd during 1956.

Total Numbers

The opportunity to ascertain total numbers of caribou in the Steese herd did not present itself at any time during the year except during the migration across the Steese Highway in June. This has been discussed in Job No. 3-b under "Highway Crossing".

It is possible, however, to obtain an adjusted figure for the herd using the indicated calf mortality, which occurred during the summer months, and the hunter take. The apparent calf mortality occurring between


CIRCLE
WHITE MOUNTAINS
YUKON RIVER
ALASKA
CANADA
Steese
Charley River
Eagle
Seela Pass
12 Mile River
DAWSON
FAIRBANKS
Salcha R.
NENANA
Goodpaster R.
40 Mile R.
Chicken
Sixty Mile R.
TANANA RIVER
Tok
Stewart R.
White River
40 Miles
General Distribution & Movements of the Steese-40 Mile Caribou Herd
-1956-
1. Wintering Area - Jan.-April
2. Calving Area - May-June
3. Summer Area - June-September
4. Migration Across Taylor Hwy. - Sept. 25-Oct. 10
5. Wintering Area - Canada
6. Wintering Area - Alaska
Direction of Movement

June and October resulted in an 80 percent loss of calves. Expressing this in actual numbers would mean a loss of 7,537 calves (80 percent of 9,422 calves accounted for in June). The calf loss plus the hunter take of 842 brings the June minimum estimated total down from 50,000 to 41,500. The total minimum population as of early winter 1956 is therefore probably somewhere between forty and forty-five thousand caribou. It must be remembered, however, that nonaccountable gains or losses of caribou can occur through emmigration or immigration, particularly during the winter months when the herd is wintering in Canada. At this time, they are close enough to the Canadian herds so that the possibility of intermingling exists. If this occurs, it could very well mask the total counts arrived at earlier.

Work Plan No. B Job No. 2-c

Management Studies of Alaska Caribou Movements, Distribution and Numbers - Arctic Caribou and other herds.

By Sigurd T. Olson

The movements, distribution, and numbers of the various Arctic herds of caribou are summarized in the following report. The information presented is not the result of a planned program but rather the result of an accumulation of data collected through the cooperation of various Fish and Wildlife personnel working in the Arctic during the year in conjunction with other work, as well as information provided through personal interviews with residents of the Arctic, pilots, both commercial and private, flying in the Arctic, members of the Canadian Wildlife Service and the Royal Canadian Mounted Police. No attempt has been made to be overly specific particularly with regard to total numbers since the bulk of the data obtained was necessarily general in nature.

As decided previously, the period covered is from January 1, 1956, to December 31, 1956, thus encompassing a "caribou year", tracing the movements from winter range to summer range and back to winter range again. As in the past, the subject is discussed on an area basis. The caribou range in the Arctic is broken down into three main divisions for this purpose as follows: Northwestern Alaska, Central Brooks Range and Eastern Brooks Range.

Northwestern Alaska

The Kobuk-Noatak caribou were scattered over a large area, a great deal of which was south of its normally accepted range during the winter of 1955-56. In recent years this herd has seldom ventured below the Kobuk or the Noatak Rivers. During November and December of 1955, however, a large segment, estimated at 20,000 animals, moved south and west to the head of the Buckland River ranging as far east as the head of the Huslia River. Other segments spread out through the Waring Mountains, south of the Kobuk River, across the Selawik Flats, and up the Selawik River more than 50 miles. Here they remained through March and into April. Estimates of total numbers in the various areas are presented in Table 1.

By mid April a definite movement north had begun and by the end of May had left their winter range and moved north into the Brooks Range. This herd was not contacted again until November. At the head of the Noatak and Cutler Rivers, fresh tracks and trails indicated several thousand caribou had been drifting north and east out of this area presumably towards the north side of the Brooks Range.

Wien pilots flying out of Kotzebue reported that no caribou had been seen in the lower Noatak-Kobuk area since the previous spring. In addition, very few caribou had been observed along the coast to Cape Lisburne. One small group of not more than 2,000 were east of Kivalina for a short period in October.

Bush pilots flying over the area north of the Brooks Range during October and November reported large numbers of caribou scattered across the Arctic slopes from Pt. Lay to Barter Island. The greatest concentration noted occurred about 50 to 75 miles southwest of Barrow and was estimated by Rev. William Wartes to be not less than 20,000.

Central Brooks Range

Caribou were widely scattered throughout the area between Survey Pass and the Chandalar River during the winter months. Wien pilots out of Bettles reported caribou in abundance in the drainage of the Alatna and John Rivers during January, February and March. Joe Miner and Harley King, during the course of predator work based at Bettles in late March, estimated approximately 17,500 in the above area. These caribou were drifting generally north at the time across the Arctic Divide. It is entirely probable that they joined forces later in the year with caribou coming through from the Noatak area. The location and estimated numbers of caribou in the Central Brooks Range as in March observed by Miner and King are presented in Table 2.

Harmon Helmericks, on May 15-16, reported an estimated 25,000 caribou moving east on the Arctic Slope between the Anaktuvuk River and the Canning River. On July 20, Andy Anderson, Wien pilot at Bettles, sighted a major concentration of caribou at the head of the Chandalar numbering between 30 or 40,000. Clarence Rhodes, John Buckley and Stan Fredericksen, on a survey August 16-17 covering the Arctic slopes of the Brooks Range, observed approximately 3,500 caribou at the head of the Saganavirktok River, however, many trails indicated that substantially larger numbers of caribou had moved along the divide across the heads of the Sheenjek and Coleen Rivers towards the Firth, thence swinging southeast towards Old Crow. It is believed that the large concentrations of caribou observed by Helmericks and Anderson kept moving east as evidenced by the trails seen by Rhodes, et. al. and eventually moved out of Alaska into the Porcupine area in Yukon Territory.

On a flight up the John River via Anaktuvuk Pass and Chandler Lake during the middle of October, Agents King and Fredericksen estimated a minimum of 10,000 caribou on the head of the Chandler River. A herd of 1,000 were seen just short of Anaktuvuk Pass. Many heavy trails crossing the John between Crevice Creek and the Pass showed large numbers of

Table 1. Estimates of Caribou Numbers -- Kobuk-Noatak Herd
January 1956 - April 1956

Area	Date	Estimated No. Caribou	Observer
Hd. Buckland River Crossing Kobuk R.	November 1955 to January 1956	20,000	S. DeLeonardis Nelson Walker
Valley in Vicinity Kiana & Noorvik	Oct.-Dec. 1955	100,000 minimum	Blankenship
between Head of Buckland River and Huslia River	April 5, 1956	10,000 minimum	Burkholder
Upper Squirrel River	April 7, 1956	5,000	"
Sheshalik	April 7, 1956	3,000	"
Klery Creek	April 6-7, 1956	1,000	Miner
Kobuk River Valley between Kiana & Shungnak	April 6-7, 1956	1,500	"
Ambler River	April 6-7, 1956	1,000	"
Shungnak River	April 6-7, 1956	5,000	"
Between Squirrel and Salmon River	April 19, 1956	5,000 minimum	"
Selawik Area	April 19, 1956	2,000	"
Ambler, Onalker, and Noatak	May 3, 1956	10,000 +	Rhode & Skoog, etc.

animals apparently headed east judging by the occassional bands encountered at the same time. Miner and Olson encountered these same trails at the head of the Chandalar and along the Arctic Divide in the Mt. Doonerak region. Keith Herrington, Wien pilot, reported that some caribou had moved to the Junjek River earlier in the fall which could conceivably be part of the above movement. Three to five thousand caribou were found wintering in the region between the East fork of the Chandalar and the head of the Christian River by Olson and Fredericksen in late November. These caribou appeared to be relatively static as most of them were still in the area in January of 1957. The location and estimated numbers of caribou observed in the Central Brooks Range area in 1956 are summarized in Table 2.

Eastern Arctic - Yukon Territory

The Porcupine caribou apparently wintered in the area between the Blackstone River and the head-waters of the Peel River in Yukon Territory, according to reports received from pilots and truckers working for Alaska Freight Lines between Eagle and Norman Wells. The spring reconnaissance flight with Clarence Rhode revealed that large numbers of caribou had moved out of this area across the Peel River valley. By May 1, the head of the movement had reached the Arctic Circle on the divide between the Black River and the Porcupine. By midsummer, these caribou appeared to have moved out of the Yukon Territory into Alaska in the eastern part of the Brooks Range northwest of Old Crow. Andy Anderson, Wien pilot, reported an estimated 30,000 caribou just north of Old Crow village on August 15. A reconnaissance by Olson and Watson in this area on August 25 indicated that these caribou had swung north moving toward the Arctic coast towards the head of the Babbage and the Blow Rivers. By September 10, the main herd had begun their southward migration and were crossing the Porcupine in the vicinity of Old Crow. Constable P. A. Robbin stated that they were headed towards the Richardson Mountains to the southeast after passing through Old Crow. No further report has been obtained since this time.

Delta River

This relatively small stationary herd of caribou ranges generally through the foothills of the Alaska Range between the Wood and Delta Rivers. Until recently, aerial counts indicated that the herd numbered between three and five hundred animals, however, counts obtained during December revealed that not less than 1,000 caribou are presently utilizing this area. King and Shepherd estimated 1,000 to 1500 caribou at the head of the Delta on December 3. Miner and Jones counted 730 on December 27 near Little Delta Creek. The increase in numbers is perhaps due to a "spill-over" from the Nelchina area via Isabella Pass during the late fall.

Table 2. Location and Estimated Numbers of Caribou Observed in the Central Brooks Range, 1956

Area	Date	Estimated No. Caribou	Observer
North Fork of Chandalar	3/26/56	1,500	Miner & King
Divide between No. Fork Chandalar and Saganavirktok	"	1,000	" "
Between John River and No. Fork of the Koyukuk River	3/28/56	5,000	" "
Alatna River Valley west of Bettles	3/29/56	2,000	" "
Head of Itkillik River	"	2,000	" "
Chandler Lake	3/30/56	6,000	" "
	Sub Total	17,500	
Between Anaktuvuk and Canning Rivers	5/15-16/56	25,000	Helmericks
Head of the Chandalar R.	7/20/56	30-40,000	Anderson
Head of Saganavirktok R.	Aug.16-17	3,500	Rhode & Buckley
Chandler Lake	Oct.17-18	10,000	King & Fredericksen
Anaktuvuk Pass	"	1,000	" "
East Fork of Chandalar R. and Head of Christian R.	Nov.	3-5,000	Olson and Fredericksen

Minchumina

The caribou in this area appear to be relatively stable. No comprehensive counts have been attempted, however, occassional counts made in connection with other work in the area indicate that between 500 to 1,000 caribou range in this area.

These caribou seem to utilize the area between Lake Minchumina and McKinley Park. There is, no doubt, a certain amount of movement in and out of the park which may cause the actual number of caribou on the flats to fluctuate from time to time.

Job No. 3(a)--Management Studies of Alaska Caribou
Calving Studies--Nelchina Herd

Period Covered: March 31, 1956 to May 15, 1957

ABSTRACT

The 1956 calving studies of the Nelchina caribou herd revealed the following information:

(1) Calving took place over some 1,000 square miles of the Talkeetna Mountains, the animals being spread out from Fog Lakes on the northwest to the head of Tyone Creek on the southeast. Six concentrations of calving occurred within that area.

(2) Aerial and ground composition counts indicated the main calving groups in the Kosina Creek area consisted of about 13 per cent yearlings, 87 per cent cows, and 1/10 per cent bulls.

(3) Bi-daily aerial calf counts traced the progression of calving, and revealed that the birth rate rose swiftly after May 20 to reach a peak on May 26, then dropped just as rapidly until about May 28, but after that decreased by an ever lessening degree.

(4) The final calf-crop was estimated at 11,000, with about 60 per cent of all cows over one-year-old having calves with them by July 1.

(5) "Infant" calf mortality from May 1 to July 1, 1956, was estimated at 10 per cent.

The raw data from which the above information was interpreted is filed in the Anchorage office of the Federal Aid branch.

OBJECTIVES

The 1956 calving studies of the Nelchina caribou herd were carried out May 17 to June 30. The objectives remained as follows:

(1) To establish the pattern of calving.
(2) To determine the final calf crop.
(3) To evaluate the causes and extent of calf mortality.
(4) To gather miscellaneous life history data.

TECHNIQUES USED

To accomplish the stated objectives, both ground and aerial observations were utilized by the investigators--Bob Burkholder, Predator Control Agent, and Ron Skoog, P-R Biologist. A Piper Supercub, with 135 horsepower engine, furnished the means for aerial transportation, equipped with ski-wheels at first and later, floats. Tazlina Glacier Lodge was used as the base for operations and a camp was set up on Kosina Creek for ground observations.

FINDINGS

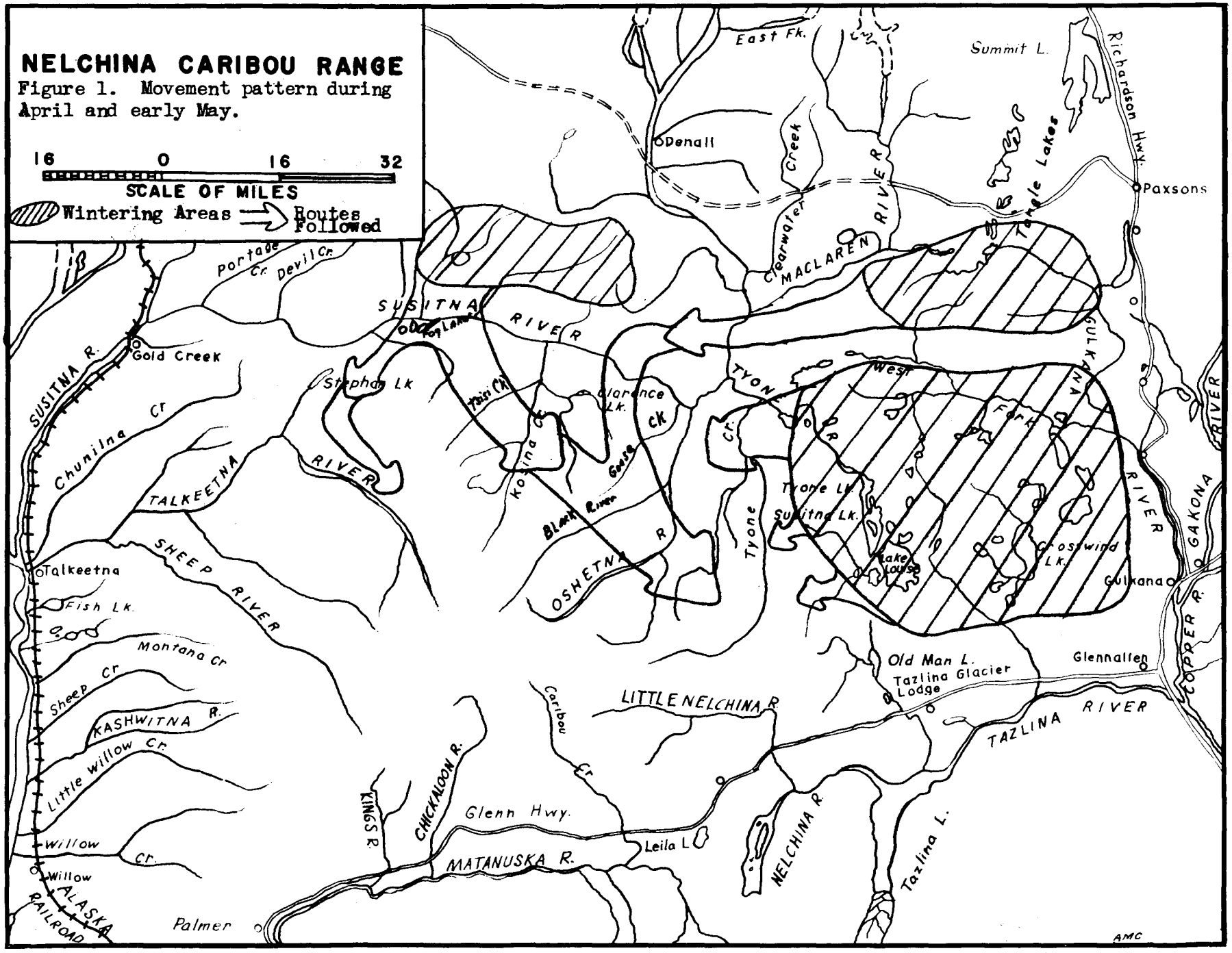
Pattern of Calving

The pattern of calving was established by determining (a) the movements and distribution of the calving groups, (b) their composition, and (c) the day by day progression of calving. The first was determined by aerial observations; the second, mainly by ground counts; and the third, by frequent aerial counts of calving groups on a calf:adult basis.

Movements and Distribution: This year the spring movements varied somewhat from those recorded in the past, and the expected calving concentration along the highlands of upper Tyone Creek and Little Nelchina River did not materialize. Instead, by the main period of calving in late May the caribou had dispersed over some 1,000 square miles, stretching from Tyone Creek westward to the Talkeetna River.

Prior to calving (March and April), most of the herd still remained in the following three wintering areas: about 15,000 in the vicinity of Deadman Lake; some 10,000 along the highlands at the heads of the Middle and West Forks of Gulkana River; and several thousand on the Ewan Lake-Lake Louise-Tyone River "flats". During latter April the calving groups moved from these areas toward the Talkeetna Mountains, and on May 11 stretched from Fog Lakes to Tyone Creek, moving in a southeast direction. All observations indicated that calving would occur at the head of Tyone Creek as expected. Figure 1 shows a generalized picture of the movements taking place during this period.

A flight on May 17 revealed the caribou still strung out from Fog Lakes to Tyone Creek, but by then the animals had reversed and were moving northwest. Long files of caribou were sighted crossing the snow fields at the divide between Black River and Kosina Creek. Along Goose Creek two young calves were sighted among the groups scattered there. By May 22 most of the movement had stopped, with the exception of groups moving into the head of Kosina Creek from the Talkeetna River. By then, six areas of concentrated calving occurred: (1) Tsisi and Fog Creeks--about 25 square miles with 1,500 adults and yearlings; (2) Kosina Creek--about 20 square miles with 3,000 adults and yearlings; (3) South of Clarence Lake--about 20 square miles with 3,000 animals; (4) Goose Creek--about 25 square miles with 2,000 animals; (5) Black River--about 15 square miles with 1,500 animals; and (6) Oshetna River-

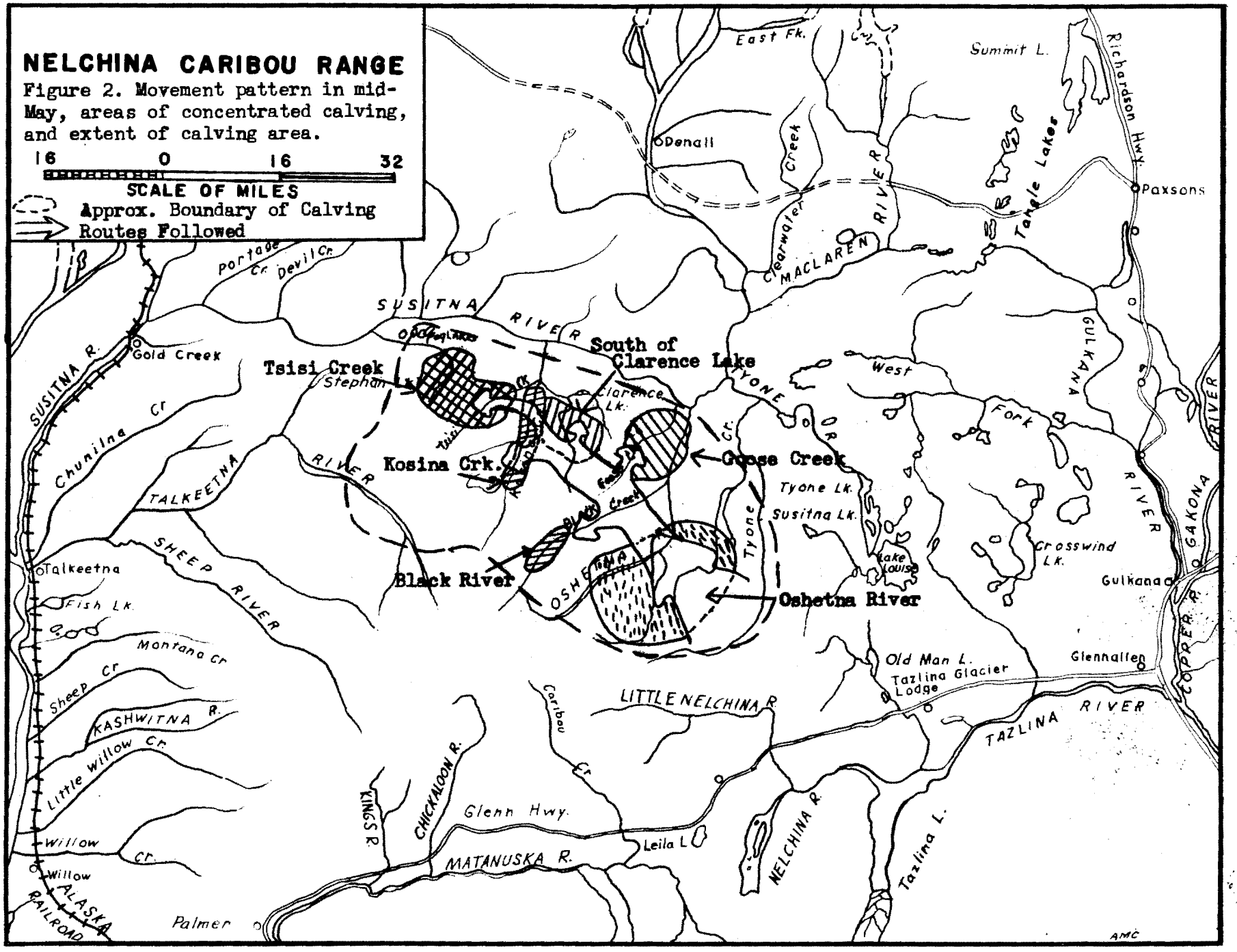

NELCHINA CARIBOU RANGE
Figure 1. Movement pattern during April and early May.
16 0 16 32
SCALE OF MILES
Wintering Areas
Routes Followed
East Fk.
Summit L.
Richardson Hwy.
Paxsons
Denali
Creek
Clearwater
MACLAREN RIVER
Tangle Lakes
Portage Cr.
Devil Cr.
SUSITNA RIVER
Old Log Landing
Gold Creek
SUSITNA R.
Stephan Lk
Chunilna Cr
TALKEETNA RIVER
Clarence Lk.
Clarence CK
Goose CK
Kosina Cr.
Black River
TYONE R.
West Fork
GULKANA R.
Tyone Lk.
Susitna Lk.
Crosswind Lk.
Lake Louise
Gulkana
GAKONA RIVER
COPPER R.
Talkeetna
SHEEP RIVER
OSHETNA R.
Fish Lk.
Montana Cr
Sheep Cr
KASHWITNA R.
Little Willow Cr.
Willow Cr.
Willow
ALASKA RAILROAD
Palmer
Caribou Cr.
LITTLE NELCHINA R.
Old Man L.
Tazlina Glacier
Lodge
Glennallen
TAZLINA RIVER
KING R.
CHICKALOON R.
Glenn Hwy.
MATANUSKA R.
Leila L.
NELCHINA R.
Tazlina L.
AMC

--about 45 square miles with 2,000 animals. In all, these areas totaled about 150 square miles and included some 13,000 adults and yearlings. Calving also occurred outside these areas, but not to any great extent. Figure 2 shows the movements taking place in mid-May, the areas of concentrated calving, and the approximate boundary of the calving area.

It is difficult to determine the reasons for the wide dispersal of the calving groups and their varied movement pattern. A major factor, however, could have been the late spring--two weeks later than usual according to long-time residents. On May 17 about 50 per cent of the upper Tyone Creek area still was covered with snow, compared with only 10 per cent at the same time in 1955 (Burkholder). Snow completely blanketed the terrain above 4,000 feet elevation except for an exposed spot here and there. Snowfree areas were limited largely to south slopes and stream bottoms. Because caribou prefer the snowfree areas both for calving and for feeding, the lingering snow could well have caused the animals to keep moving until suitable areas were reached or until parturition became eminent. Cool weather retarded both the thaw and the vegetative growth, and not until after May 24 did the melting proceed rapidly and the willow buds appear. By then, however, the caribou movement had stopped, and the animals had settled in the areas shown in Figure 2.

Past observations have indicated that the spring movement at first usually consists of staggered lines of large groups of caribou. As parturition approaches these groups break into smaller ones and spread out over the calving area. After the calves are born, the animals reassemble into larger and larger groups until the post-calving movement takes place. In order to demonstrate this movement pattern the investigators recorded the sizes of caribou bands during all aerial flights. A total of 1,727 bands was tallied May 17 to June 11. The average band size varied as follows: 35 animals per band on May 17; 5 per band from May 22 to May 28, with none containing more than 50 animals; 10 per band on May 30; and 30 per band from June 2 to June 11. These few data tend to verify the pattern mentioned above, but more are needed for a better picture.

The caribou remained rather stationary during the May 22-28 period, when the average band size was only 5. May 29 marked the first day that any noticeable movement occurred, when several small groups moved eastward from Kosina Creek. This movement into the area south of Clarence Lake continued for the next two weeks, gradually shifting to the southeast, with more and more large bands (over 200 animals) becoming evident. By June 11 the southeast movement had assumed large proportions. Meanwhile, some animals of the Tsisi and Fog Creek group had moved southwestward toward the Talkeetna River, but they totaled probably no more than 1,000. By June 14 several thousand of the southeast movement had reached a point just west of the Oshetna River, although many caribou still remained farther to the west. The next flight, on June 26, revealed a concentration of some 10,000 caribou in the highlands just east of the Oshetna River, with a straggling


NELCHINA CARIBOU RANGE
Figure 2. Movement pattern in mid-May, areas of concentrated calving, and extent of calving area.
16 0 16 32
SCALE OF MILES
Approx. Boundary of Calving
Routes Followed
East Fk.
Summit L.
Richardson Hwy.
Paxsons
Denali
Clearwater Creek
MACLAREN RIVER
Tangle Lakes
Portage Cr.
Devil Cr.
SUSITNA RIVER
South of Clarence Lake
Tsisi Creek
Stephan L.
Clarence L.
Kosina Crk.
Goose Creek
Tyone Lk.
Susitna Lk.
Black River
OSHETNA
Oshetna River
Tyone
West Fork
GULKANA RIVER
Crosswind L.
Lake Louise
Gulkana
GAKONA
COPPER R.
Old Man L.
Tazlina Glacier Lodge
Glennallen
TAZLINA RIVER
LITTLE NELCHINA R.
Caribou Cr.
Gold Creek
SUSITNA R.
Chunilna Cr.
TALKEETNA RIVER
Talkeetna
Fish L.
Montana Cr.
Sheep Cr.
SHEEP RIVER
KASHWITNA R.
Little Willow Cr.
Willow Cr.
Willow
ALASKA RAILROAD
Palmer
KINGS R.
CHICKALOON R.
Glenn Hwy.
MATANUSKA R.
Leila L.
NELCHINA R.
Tazlina L.
AMC

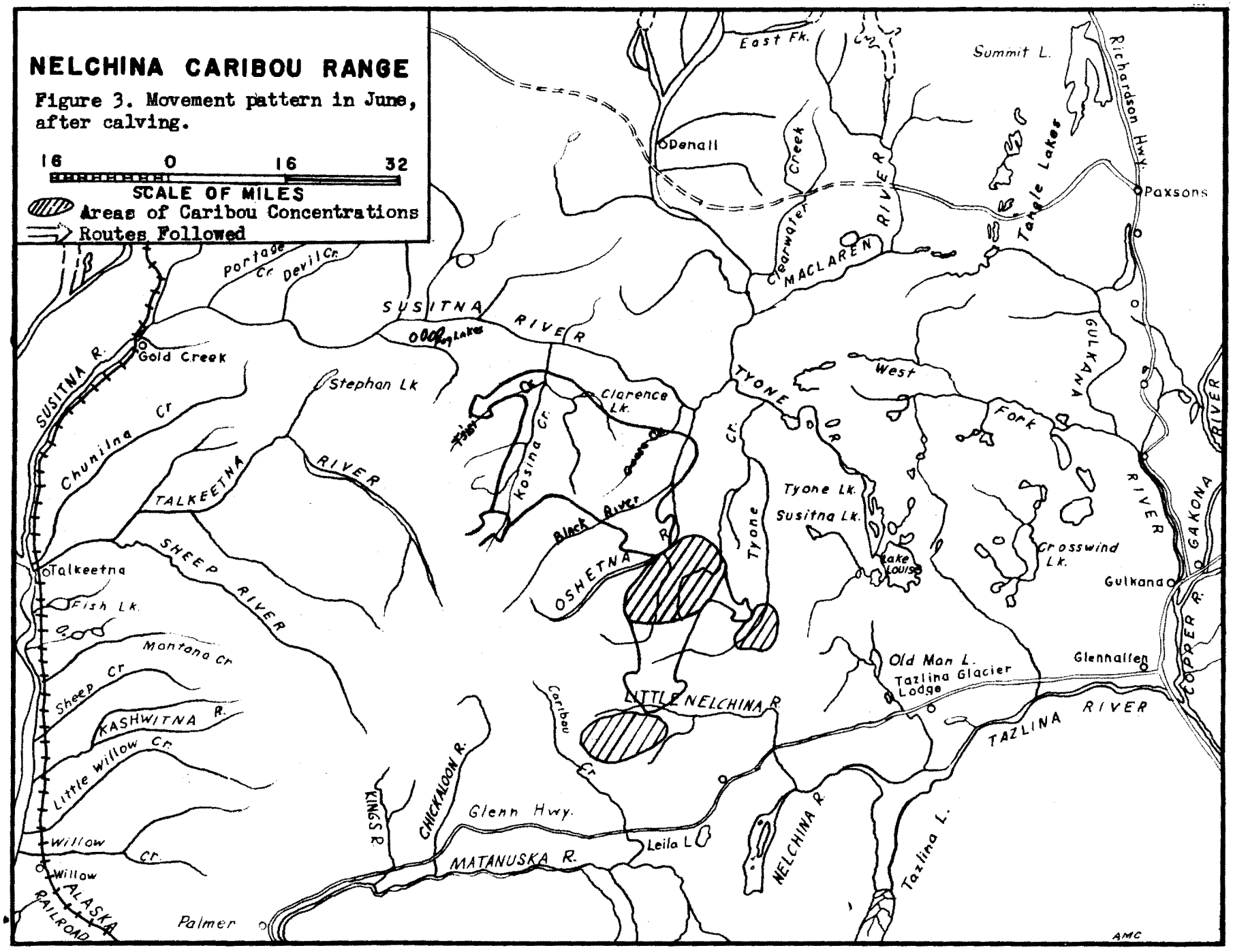
movement to the south and another concentration of several thousand at the head of Caribou Creek. On July 2 the latter area contained about 10,000 caribou. Another group of about 5,000 had moved to the upper Tyone Creek area. Figure 3 shows these post-calving movements and concentration points. All movements described thus far pertain to the calving groups--cows, calves, yearlings, and a smattering of young bulls. The estimates stated do not include calves. Bulls were scattered throughout the Nelchina range, but by early July many had moved to the highlands at the heads of the Talkeetna, Oshetna, and Little Nelchina Rivers.

Composition of Calving Groups: Composition counts were made periodically. These were used to determine the reliability of the calf:adult tallies taken throughout the calving period and to evaluate the final calf crop. The data were taken mainly from the Kosina Creek and South of Clarence Lake areas, because there the calving groups were most concentrated and were most accessible from the ground. Most aerial work centered on these areas, also.

The first ground counts were taken on May 17 from files of caribou moving into Kosina Creek from the east. Only 378 animals were tallied, but these seemed quite representative of the hundreds that streamed past beyond the range of accurate segregation. Of those tallied, 306 (81.0 per cent) were cows and the remaining 72 (19.0 per cent) were yearlings; no bulls were sighted at any time. A tally of antlered animals revealed that 17 (25.4 per cent) of 67 yearlings still retained their hard antlers, and that 263 (85.9 per cent) of the 306 cows still had theirs. Concerning the latter, the author believes that only those cows still bearing hard antlers in early May will give birth. Further discussion of this point appears later. The yearling figure of 19 per cent seems low when compared with the 23 per cent obtained the previous March, especially because the latter pertained to the herd as a whole, whereas the former, only to cows and yearlings. Apparently some yearlings already had dropped out of this movement of calving groups, a phenomenon noted in past years, also.

Further ground counts were taken on each of eight days between May 23 and June 6 from the Kosina Creek caribou. These counts included 1,136 caribou (calves excluded), of which 142 (12.5 per cent) were yearlings, 993 (87.4 per cent) were cows, and 1 (0.1 per cent), a bull. The low number of yearlings further illustrates the dissociation of these animals from the cows during the calving period. A disparity in the expected sex ratio was noted, also: of 49 yearlings sexed, 15 were males and 34, females. This variance from the assumed normal 1:1 sex ratio is statistically significant when tested by the Chi-square method, and implies that the male yearlings tend to leave the calving groups more so than do the female. Similar data have resulted from calving studies made on the Steese-Fortymile caribou.

During the same period, while making bi-daily (every other day) calf-counts, the investigators also attempted to obtain composition data from the air. All the counts so obtained were taken of entire


NELCHINA CARIBOU RANGE
Figure 3. Movement pattern in June, after calving.
16 0 16 32
SCALE OF MILES
Areas of Caribou Concentrations
Routes Followed
East Fk.
Summit L.
Richardson Hwy.
Paxsons
Denali
Creek
Clearwater
RIVER
MACLAREN
Tangle Lakes
Portage Cr
Devil Cr.
SUSITNA RIVER
Gold Creek
SUSITNA R.
Stephan Lk
Clarence Lk.
Kosina Cr.
Chunilna Cr
TALKEETNA
RIVER
SHEEP RIVER
Talkeetna
Fish Lk.
Montana Cr
Sheep Cr
KASHWITNA R.
Little Willow Cr.
Willow Cr.
Willow
ALASKA RAILROAD
Palmer
KINGS R.
CHICKALOON R.
Glenn Hwy.
MATANUSKA R.
Leila L.
Caribou Cr.
LITTLE NELCHINA R
NELCHINA R
Tazlina L.
TAZLINA RIVER
Old Man L.
Tazlina Glacier
Lodge
Glennallen
COPPER R.
GAKONA RIVER
GULKANA
West
Fork
RIVER
Crosswind Lk.
Gulkana
Lake Louise
Tyone Lk.
Susitna Lk.
TYONE
CR.
Tyone
OSHETNA R.
Black River
AMC

bands, but by necessity mainly of groups containing less than 15 animals; larger groups required too much flying time for complete segregation. Of 2,359 animals so tallied (calves excluded), 421 (17.8 per cent) were classified as yearlings, and 1,938 (82.2 per cent), as cows; no bulls entered the tally, and very few were sighted at all. The variance evident between the aerial and ground counts probably results largely from the yearling count. From the air it is difficult to separate yearlings from two-year-old cows. The presence or absence of new antler growth was the main criterion used in separation--most "two-year-old" cows having 2 to 3 inches of new growth by the end of May, whereas the yearlings at most having only bumps. As a result, some two-year-olds probably entered the yearling count, which therefore would be somewhat high. Also, yearlings tend to be more numerous among the small and the "fringe" groups of animals, from which much of this tally was taken--a factor also tending to pad the yearling count. Two-year-old bulls, of course, are difficult to segregate from the cows having new antler growth, because both will have from 2 to 6 inches of velveted antlers at that time. Older bulls are readily identified. All these factors tend to make aerial composition counts of questionable value if used alone, but ground counts taken in conjunction can provide the necessary base for accuracy. Nevertheless, if composition counts were made from the air at the same time the calf:adult counts were made, the resulting data would be useful both in detecting changes in the structure of the calving groups and, later, in allowing the adjustment of "inconsistent" calf percentages obtained in the counts.

Table 1 lists the composition figures obtained from ground and aerial counts taken during the calving season. The figures believed to be most valid--those representative of the caribou from which the calf:adult tallies were taken--are the ground counts of May 23 to June 6. These indicate that the main calving groups consisted of about 13 per cent yearlings, 87 per cent cows, and 1/10 per cent bulls.

Table 1. Results of composition counts taken from calving groups of the Nelchina caribou herd, May-June, 1956.

	Ground Counts				Aerial Counts	
	May 17 (Pre-calving)		May 23 to June 6 (Calving)		May 23 to June 6 (Calving)	
	Number Tallied	Per Cent	Number Tallied	Per Cent	Number Tallied	Per Cent
Total Animals	378		1,136		2,359	
Yearlings	72	19.0	142	12.5	421	17.8
Male			15	30.6		
Female			34	69.4		
Cows	306	81.0	993	87.4	1,938	82.2
w/antlers	263	85.9				
w/o antlers	43	14.1				
Bulls	0	0.0	1	0.1	0	0.0

Progression of Calving: Bi-daily aerial calf counts provided the data needed to determine the rise, peak, and fall, hence progression, of calving. The counts were taken from the caribou concentrated in the Kosina Creek and South of Clarence Lake areas, because those calving groups seemed most representative of the herd and because the data obtained were then comparable to that obtained from the ground. All calf counts were recorded on a calf:adult basis--adults here referring to all animals other than calves.

Calving apparently began shortly after May 10. A report on May 14 from a trapper on Valdez Creek disclosed that he had seen 9 new calves among a band of 25 caribou several days previous. These caribou were part of several hundred scattered over an area some 40 miles north of the main calving activity. A reconnaissance flight on May 17 over the main areas, however, revealed only two calves among the several thousand animals sighted. A calf:adult count did not seem necessary that day, but then a delay in operations prevented any counts until May 22. After the latter date counts were taken regularly, usually every other day, from the caribou concentrated in the two areas mentioned above. Occasionally other areas were checked. Table 2 lists all the calf:adult counts made during the calving season.

The Kosina Creek counts were the most complete, and hence illustrate best the progression of calving. The variances in the calf:adult percentages evident among the six areas resulted mainly from differences in band composition, i.e., one area having more or less yearlings and non-breeding cows than another, but, also, probably from actual differences in the times of parturition. Inconsistent percentages after June 4 resulted from the changing composition of the bands as they merged and picked up the fringe groups of yearlings and non-breeding cows. The ultimate calf:adult figure, if the composition had remained constant, is assumed to approach 70 per cent. Figures 4 and 5 show graphic representations of the data presented in Table 2, and illustrate better the rise, peak, and fall of calving activity.

Figure 5 reveals that the birth rate rose rapidly from May 23 to reach a peak on May 26. The rate then dropped just as rapidly until about May 28, but after that decreased by an ever lessening degree. The data obtained indicate that calving probably does not follow a normal curve, as interpreted from last year's data. There appears to be a distinct skewness to the right, and a logarithmic normal curve might fit closely the observed data points. Inconsistencies or inaccuracies in the counts, however, both this year and last, as well as undetected variables such as fluctuating band compositions or non-representative calving groups, all could cause distortions. Continued and more complete data gathering in the future should resolve most of the present inadequacies. Nevertheless, the calving peak indicated--May 26--corresponds closely with that obtained last year and probably represents a close approximation to the true peak for this herd.

Table 2. Calf:Adult counts taken from Nelchina caribou during 1956 calving season, listed by date and calving area.

Date	Tsisi-Fog Crks. A	C	%	Kosina Crk. A	C	%	South of Clarence Lake A	C	%	Goose Creek A	C	%	Black River A	C	%	Oshetna River A	C	%
5/22/56				907	93	10.3												
23	611	39	6.4	357	43	12.0							385	15	3.9			
24				984	166	16.9												
25																		
26	501	49	9.8	483	167	34.6												
27																		
28				410	190	46.3	341	109	32.0									
29																		
30	190	60	31.6	583	317	54.4	402	148	36.8									
31																		
6/ 1/56				1262	738	58.5												
2				686	414	60.3	723	527	72.9									
3																		
4				1110	740	66.7	1280	820	64.1	891	509	57.1	402	148	36.8	560	240	42.9
5																		
6																		
7																		
8				830	470	56.6	767	533	69.5									
9																		
10																		
11				894	556	62.2												

Figure 4. Graphic representation (by eye) of calf:adult percentages obtained from Nelchina calving groups in the Kosina Creek area, May-June, 1956.

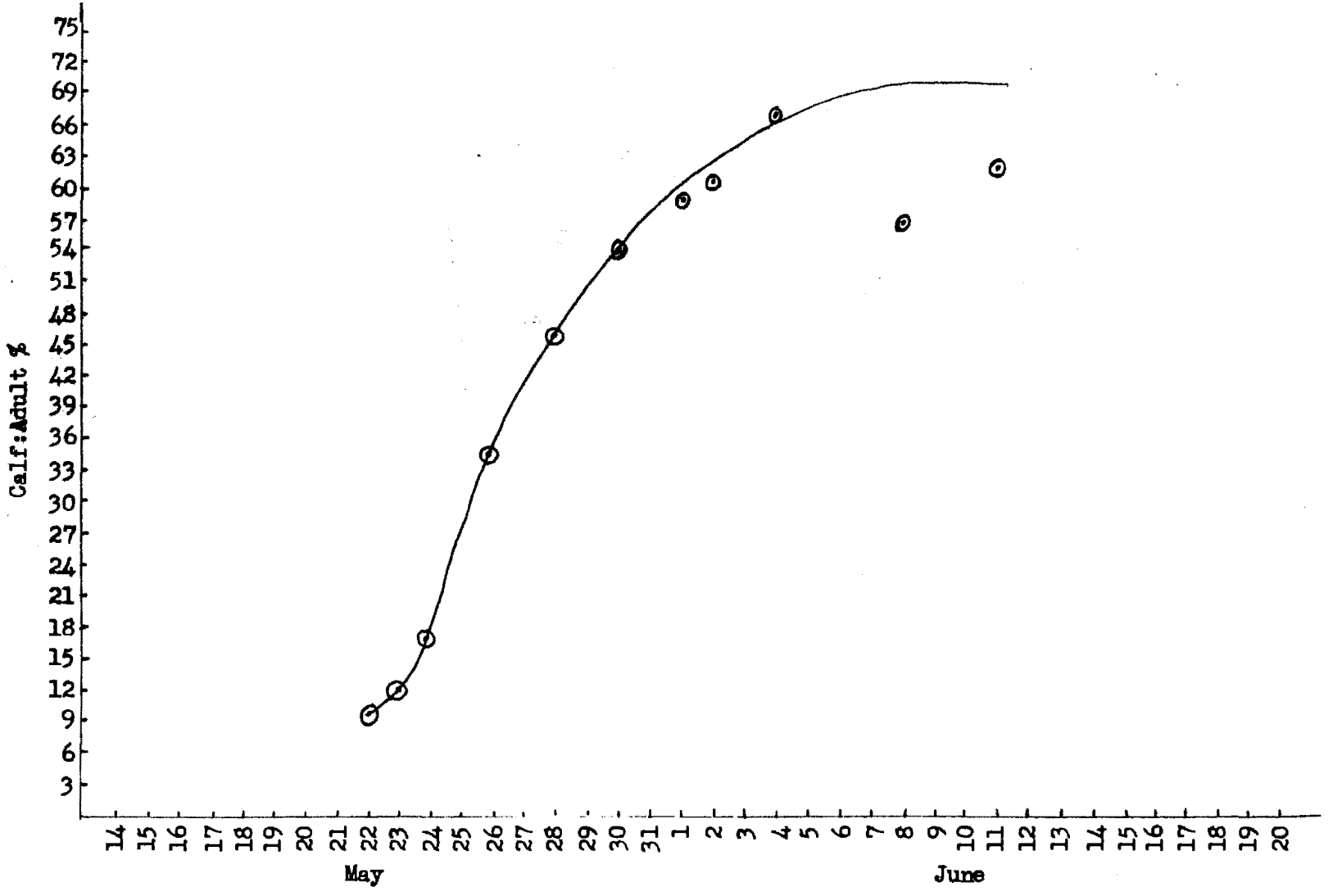
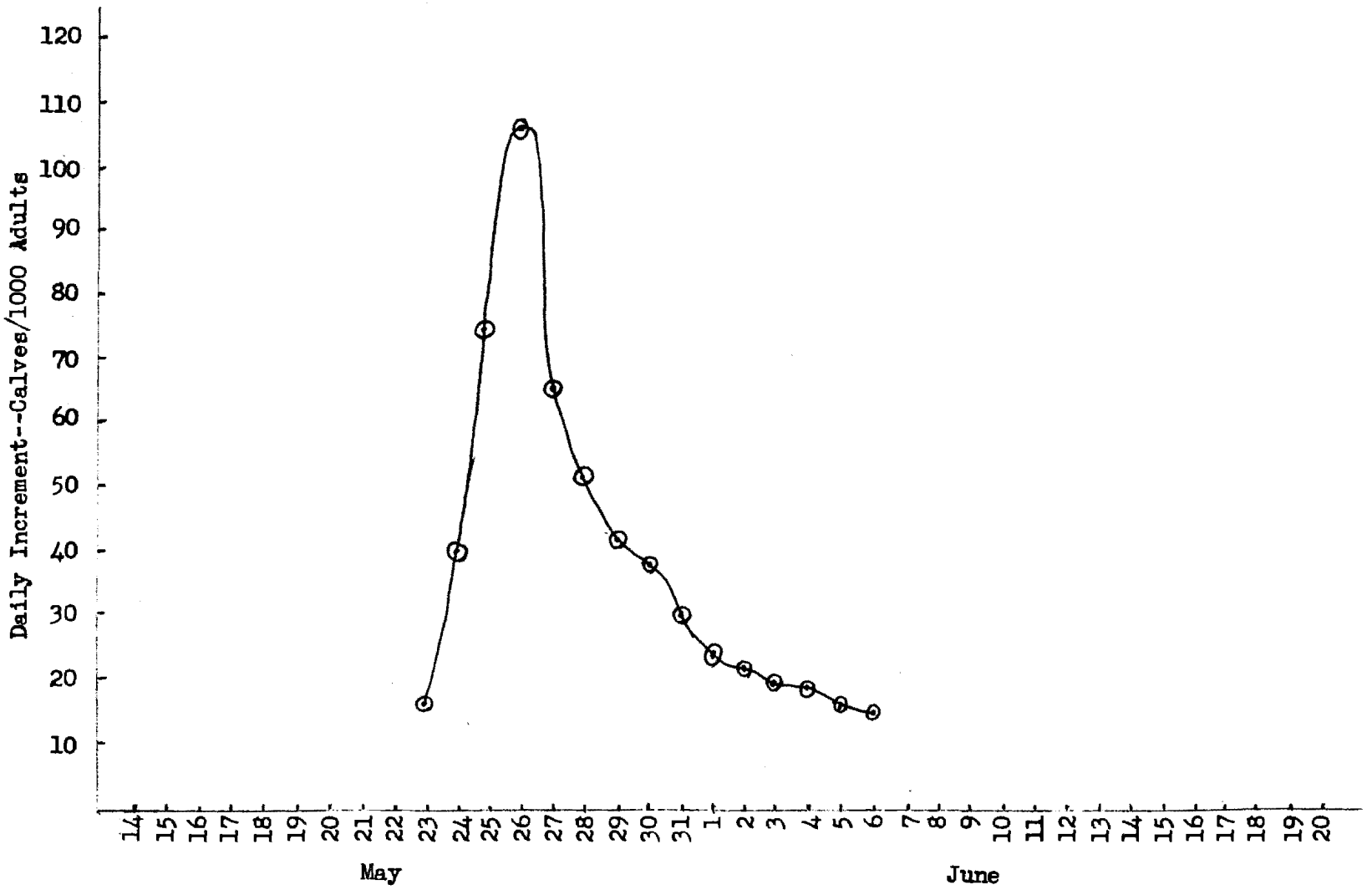


Figure 5. Daily increment of calves as derived from calf:adult percentages obtained from Nelchina calving groups in the Kosina Creek area, May-June, 1956.



Final Calf Crop

Determining the final size of the calf crop constitutes the most important phase of the calving studies. Perhaps the best method of obtaining this figure is through extensive ground counts in late June, after calving, when most of the calves are older than two weeks. By then the "infant" mortality factors (those affecting a calf during the first week of life) have taken their toll, and the remaining calves represent the final crop. Such counts were attempted June 27 to July 2, but the "counters" were left behind when the caribou moved out of reach. As a result, the data obtained were quite limited; the ground and aerial counts taken on the calving grounds earlier, however, provided enough additional information for the final computation.

The largest calf:adult percentage obtained from the aerial counts of the Kosina Creek caribou occurred on June 4--66.7 per cent. After that date the percentages fluctuated because of changing band compositions, but it was assumed that the percentage would have approached 70 had the bands remained constant. If there were 70 calves per 100 adults, the calf:total animal percentage would be 41 and the adult:total animal, 59. Ground counts (May 23-June 6) showed that among the adults about 13 per cent were yearlings, 87 per cent cows, and 1/10 per cent bulls. Therefore, after the assumed maximum calf: adult ratio was reached, every 1000 animals of the Kosina Creek area consisted of 410 calves and 590 adults, and the latter, of 76 yearlings, 513 cows, and 1 bull. Thus the calf:cow ratio would be .80, meaning that 80 per cent of the cows had calves. This figure, of course, refers strictly to the main calving groups, composed principally of the producing cows, and applies specifically to those groups in the Kosina Creek and South of Clarence Lake areas. These two were quite similar both as to the composition of the animals present and to the progression of calving; they contained about half of the 13,000 caribou (calves excluded) estimated for the entire calving region as outlined in Figure 2.

The composition of the animals in the other four areas (see Table 2) varied noticeably from the above two, many more young and/or non-producing cows being present, as well as more yearlings and bulls. Thus the calf:cow ratio would be lower in those areas, as would the ratio for the herd as a whole. It is difficult to compute the final calf:cow ratio for the entire herd without adequate ground counts after calving and without complete knowledge of the herd composition. The few counts obtained June 27 to July 2 gave some indication of this final ratio, because by then the caribou scattered over the calving grounds had mixed and the groups contained a more valid distribution of the producing and non-producing cows. Unfortunately, the data probably are somewhat biased, because the counts were few in number and were taken from the rear of the movement, where cows with calves usually are less numerous. Nevertheless, of the 406 animals tallied, 118 were calves, 46 were yearlings, 215 cows, and 27 bulls. Also, of 167 cows tallied, 111 or 66.5 per cent had udders, indicating that that percentage of the cows tallied had produced calves.

That percentage, when compared with the 80 per cent (a minimum figure in regard to total calf production, because it pertained only to the number of cows with calves) obtained from the counts taken earlier from the Kosina Creek caribou, shows that a substantial number of non-producing cows had joined the calving groups. Because the cows with calves probably were not represented fully, the resulting calf:cow ratio of .55 (118:215) probably is low. The true ratio for the herd at the end of June should lie between .55 and .80. The writer estimates this final ratio to be about .60, meaning that 60 per cent of the total number of cows older than one year were followed by calves at that time (after "infant" mortality had had its effect).

To express the final calf crop in round figures requires a knowledge of the total number of cows in the herd. Composition data obtained in October, 1956, from counts taken of Nelchina caribou indicate that about 47 per cent of the animals tallied (calves excluded) were cows over the yearling age-class. Past data from the Steese-Fortymile caribou herd showed a percentage of about 46 there. The census of 1956 revealed that the Nelchina herd contained about 40,000 animals. Of that number, about 19,000 were adult cows, based on the 47 per cent figure above, and an estimated 60 per cent of these were followed by calves at the end of June. Thus, the final calf crop of the Nelchina caribou herd in 1956, as of July 1, totaled about 11,000 calves.

In retrospect, the 1956 calving studies produced the following data regarding the calf crop:

1. About 80 per cent of the cows in the Kosina Creek and South of Clarence Lake areas had calves by mid-June.

2. An estimated 60 per cent of all the cows older than one year in the total herd had calves by July 1.

3. The total number of calves added to the herd as of July 1 is estimated at 11,000.

Calf Mortality

A third aspect of the studies attempted to determine the causes and extent of calf mortality. Field observations during the calving period identified the mortality factors present. The knowledge of these, plus other information, such as dead calves tallied, aerial and ground counts, etc., provided the means for evaluating the extent of calf mortality for the May-June period.

Causes: The main mortality factors adversely affecting calf survival are (1) innate physical weaknesses of calves, (2) intra-specific strife, (3) accidents, (4) inclement weather, and (5) predation. The first two vary least from year to year, and thus would tend to make up a fairly constant percentage of the mortality annually. The

accident incidence probably does not vary greatly either, but can be altered both by the amount of stream flow, as affected by the time and severity of breakup, and by the type of terrain in which the calving takes place. Weather, of course, fluctuates greatly, and conceivably might wipe out a major portion of the calves if severe enough. Predators could cause much havoc in the calf crop, if their populations were large; only the wolf, or possibly the coyote, however, could exert such an effect. Thus, the mortality factors most apt to cause fluctuations in calf survival are accidents, weather, and predators, even though innate calf weaknesses and intraspecific strife do take a large, annual toll of the new calves.

Sixteen dead calves were tallied on the calving grounds in 1956 during aerial and ground surveys. Of that number, three were still-born, this fact being determined from the position of the body, as illustrated in Figure 6. The causes for such congenital deaths among caribou remain unknown at present, but they could result from a variety of factors, such as the malnutrition of the cow or the defective placental attachment of the embryo. Those calves that are born alive but physically weak probably do not live long, because their rigorous nomadic life must soon wear down their strength. The traversing of steep, rocky slopes, swift streams, and extensive muskeg requires great stamina, and none but the healthy survive. The cause of death for ten of the dead calves sighted could not be determined; any could have died, directly or indirectly, from innate physical weaknesses.

Field observations have revealed that intraspecific strife is a common cause of "infant" mortality. Cows often react quite violently toward any strange calf that wanders near, striking viciously at it with head or forefeet. If the cow still retains hard antlers the calf can be stabbed mortally; several dead calves examined in the past from the Steese-Fortymile herd had puncture wounds attributed to antler thrusts. Striking with the forefeet can inflict mortal internal injuries, also; three of the sixteen dead calves tallied last year on the calving grounds of the Nelchina herd had internal injuries that probably caused death. Two instances were observed in which a cow struck down a calf, and then continued to strike it as it lay on the ground. Both calves regained their feet, but staggered visibly, indicating they definitely were hurt. Trampling could cause similar internal injuries, and probably does quite commonly. The writer has observed at least a dozen instances in which calves were knocked off their feet when a caribou band stampeded suddenly. As a whole, however, calf mortality caused by the caribou themselves affects mainly those calves less than five days old; after that age they are agile enough to avoid their elders. This type of calf mortality probably remains fairly constant. Fluctuations are apt to occur from year to year due to the changing concentrations (densities) of cows on the calving grounds--i.e., in some years they are spread over a small area and in others, over a large; population size, as such, probably is not an important factor.

As yet, no dead calf has been found in which the death can be attributed to accident. The accidental deaths that undoubtedly do

occur probably are limited to drowning or falling--the former in crossing swift streams or by dropping through the ice, and the latter by falling from cliffs. Time and speed of breakup, amount of precipitation, and stream flow are the factors most apt to affect the drowning incidence. Again the young calves are those affected most, because by the age of one week they are strong swimmers, judging from an observation last spring of a caribou band crossing a small, but swift, stream. Large rivers are more dangerous, yet two observers witnessed the safe crossing of the upper Susitna River by several hundred animals in early August, 1956; the water was high and swift, but the calves had no trouble reaching the opposite bank. The other factor contributing to accidental deaths--falling from cliffs--cannot constitute much of the total mortality, because the type of terrain in which most of the calving takes place is not rugged enough. Snowdrifts are another possible source of mortality for young calves. The deep, soft drifts of late spring conceivably could trap a few, although no evidence exists to support this view. Certainly the drifts act to wear down the weak ones, for calves struggling across the snow are a common sight during May. Nevertheless, accidental deaths probably are not an important source of calf mortality during May and June except under special conditions, as indicated above--e.g., swollen streams.

Weather exerts a strong influence on the success of calving, and affects calf survival both directly and indirectly. Severe conditions can wipe out a large portion of the calf crop; apparently such a catastrophe was reported as happening in 1947 to several caribou herds of the Canadian arctic. Late breakups, snowstorms, low temperatures, and heavy rains all tend to increase calf mortality. Caribou calves are extremely hardy, however, and seem able to withstand all but the most adverse conditions, even at birth. On May 22, 1956, the observers sighted groups of caribou on the snowfields between the Talkeetna River and John Creek, a tributary of Kosina Creek; these groups contained a number of new-born calves, and all seemed in good condition despite the low temperatures and the deep snow. Although weather can be the most severe of the factors affecting calf survival, its variability from year to year is great. It has not affected greatly the Nelchina calf-crop in recent years, but the late breakup and cool temperatures probably caused some additional mortality last spring.

Predators that kill young calves include the eagle, wolverine, and bear, and the coyote and wolf. Eagles are common, but not numerous, throughout the calving grounds. These birds, however, are limited mostly to strays, because cows do protect their young from eagle attacks, and by strength mostly to those calves less than two-weeks old. The wolverine and bear are common inhabitants of the calving grounds also, but are limited in number and range. They can easily catch the new-born ones, but most week-old calves can outrun them after the first 100 yards or so. These three predators do not affect calf survival much, and their populations remain rather stable from year to year. The coyote and the wolf, however, are effective killers and,

if their populations were high, could cause noticeable depletions in the calf crops. At present these predators are not numerous, and the observers noted no sign of either on the calving grounds in 1956. In recent years, predators have not been a serious threat to calf numbers.

Thus, the most important causes of calf mortality during the May-June period in 1956 were innate physical weaknesses of calves, intraspecific strife, and perhaps weather. Neither accidents nor predation exerted much effect.

Extent: Transposing the effect of the mortality factors to actual figures proves difficult, and at present there is no possibility of assessing each factor separately. However, the total calf-mortality for the May-June period at least can be estimated, although the many variables existing preclude exactness. Three possible methods have evolved for estimating the extent of "infant" mortality:

(1) antlered versus unantlered cows before calving;
(2) dead calves/square mile of coverage versus total area of calving grounds; and
(3) udder versus udder-less cows after calving.

All methods require a knowledge of the extent of calving activity, the movements and composition of the calving groups, and the final calf:cow ratio.

The first method assumes that a relationship exists between antlered cows and pregnancy. The writer believes that only those cows that are carrying foetuses in early May will have hard antlers then, but so far only circumstantial evidence exists to support this view. If this were true, however, a tally at that time of antlered and unantlered cows would show the initial calf:cow ratio. The difference between that figure and the final calf:cow ratio, obtained after calving, would reveal the calf mortality occurring during the calving period. Such a tally was taken on May 17, 1956, from calving groups moving into the Kosina Creek area. The tally (see Table 1) included only 306 cows, but these seemed quite representative of the hundreds that streamed past. Of the 306 tallied (yearlings excluded), 263, or 86 per cent, still retained their hard antlers, and therefore, by the above assumption, were pregnant. This percentage, when compared with the computed final calf:cow figure of 80, indicates a calf mortality of 7 per cent.

The second method assumes that ground observers see approximately the same number of dead calves per square mile of ground coverage as exists over the entire calving area. The proportion--area covered:total area::dead calves found:total dead calves--provides an estimate of the total number of dead calves. This estimate is a maximum one when the area covered is minimum and the total area is maximum. Next, to find the calf mortality, the dead-calf total is compared to the total number of calves born, the latter figure being obtained from the final

calf:cow ratio and the estimated number of cows on the calving grounds. The two observers covered a minimum of .3 square miles of the Kosina Creek and South of Clarence Lake calving areas in 1956. This figure assumes that the observers could examine the ground closely over a 40-foot swath, and that they walked a minimum of 35 miles. The dead calves found totaled 4; the maximum square-mileage of these calving areas was estimated at 40. These figures substituted in the proportion mentioned above provide a maximum total-dead-calf figure of 530 for the areas indicated. That region contained an estimated 6,000 adults (including yearlings) and, at the end of calving, 4,200 calves (a final calf:adult ratio of .70). Thus the total number of calves born equals 4,730, and the calf mortality reaches a maximum of 11 per cent.

The third method assumes that at the end of calving all cows that were pregnant still have an easily discernable udder. If so, then a tally of cows with udders and of cows with calves should give a direct indication of calf mortality. Unfortunately the ground counts after calving were quite limited, and only 167 cows were tallied. Of these, however, 111 had udders, but only 83 had calves. A comparison of the resulting percentages--67 and 50, respectively--shows a calf mortality of 25 per cent.

Table 3 compares the results of the three methods. As indicated, the estimates for calf mortality varied greatly--7, 11, and 25 per cent.

Table 3. Comparison of three methods for obtaining "infant" mortality estimates from the 1956 calving of the Nelchina caribou herd.

	METHOD		
	1. Antlers	2. Dead Calves	3. Udders
Initial Calf:Cow Ratio	(cows w/antlers) .86[a]	.90	(cows w/udders) .67[a]
Final Calf:Cow Ratio	.80[b]	.80[b]	(cows w/calves) .50[a]
Difference	.06	.10	.17
Estimated Mortality	.06/.86 = 7%	11%[b]	.17/.67 = 25%

[a] Direct Tally

[b] Computed

The third, or "udder", method should be the most accurate, because the only variable is sampling error. This, however, hinges upon sample size and randomness (whether the portion of the herd sampled represents the whole), and both served to make the results inaccurate. First, the sample size was too small--only 167 cows tallied--and, second, these cows were tallied from the rear portion of the post-calving movement, where cows with calves were less numerous. Therefore,

the 25 per cent estimate obtained probably is much too high.

The next most accurate method of the three should be the first one--antlered versus unantlered cows--because the tally is direct and, therefore, the only variance is sampling error. Knowledge is lacking, however, as to whether or not in early May only antlered cows are pregnant and all unantlered cows, not pregnant. Again the sample taken was small--only 306 cows--and the portion of the herd sampled might not be representative. The writer believes the 7 per cent estimate obtained to be slightly low.

The least accurate method for estimating calf mortality is the second one--dead calves found versus ground coverage. Estimates form the basis for the computation, and these can be manipulated so easily that each person using the method probably would have different results. The 11 per cent mortality figure could be high or low.

The true figure for "infant" mortality probably lies between 7 and 25 per cent, but exactly where is difficult to judge. The writer believes the former percentage to be more accurate, because the data on which it is based seems fairly reliable. As such, realizing his fallibility, he places the calf mortality during the May-June period of 1956 at about 10 per cent of the total calves born.

Miscellaneous Life-History Data

No effort was made specifically to tag calves, but the investigators did catch and ear-tag four. General information on these follows:

Date	Tag Nos.	Sex	Age	Weight	Locality
5/22/56	224 225	F	1/2 day	13#	Kosina Creek
	222 223	M	1/2 day	--	Kosina Creek
5/31/56	220 221	M	1-2 days	--	Kosina Creek
6/5/56	218	F	2 days	8#	Kosina Creek

The last calf was quite small and rather weak, and in all probability died in a few days.

Opportunity existed to gather various types of life-history data, such as behavior, progress of antler growth, body weights and measurements, food habits, phenological information, etc. None of these is part of the calving study, as such, and hence will appear in other portions of the report.

RECOMMENDATIONS

The results of the 1956 calving studies reveal gaps that should be concentrated on in the future. A concerted effort should be made to obtain the following information:

1. Obtain a better picture of the progression of calving by taking daily or semi-daily calf-counts on a specific group of calving caribou.

2. Establish definitely whether only antlered cows in early May will bear calves.

3. Determine the feasibility of tallying cows with udders versus those without, after calving, as a means for evaluating "infant" calf-mortality.

Prepared by:

Ronald O. Skoog
Wildlife Management Biologist

Approved by:

Robert F. Scott
Supervisor of Game Restoration

Date: May 15, 1957

Work Plan No. B
Job No. 3-b

Management Studies of Alaska Caribou -
Calving Studies - Steese Fortymile Herd
By Sigurd T. Olson

The 1956 calving season marked the fourth consecutive year that the calving of the Steese Fortymile Herd has been under observation. Aside from general surveys designed to keep track of herd distribution and movements, little specific aerial work was done prior to 1955 and 1956, ground surveys providing the bulk of the information on the actual calving activity in 1953 and 1954. Although some vital data was collected during these two years, the shortcomings of being earthbound were realized and more intensive aerial work was initiated. In addition to noting movements and distribution, aerial work consists essentially of calf counts throughout the calving period. Ground work continues to serve as a check on aerial counts and to collect "fill-in" data impossible to obtain by air. Aerial surveys in 1955 were rather exploratory in nature using a Piper Pacer. It was found that the Pacer was unsatisfactory for the job and therefore a Super-Cub was used in 1956. This operation was much more efficient and produced a considerably greater amount of usable data than was possible in 1955. Comparison of data between 1955 and 1956 is possible to some extent, however information obtained in 1956 produced results which will probably assume considerably more significance as similar information is collected and analyzed in subsequent years.

Calving studies during May and June of 1956 were primarily designed to obtain the following information:

1. Timing, pattern and location of calving
2. Relative size of the calf crop
3. Causes and extent of calf mortality
4. Age and sex composition of caribou on the calving area.

The field work, both air and ground, was accomplished by Joe Miner and Sig Olson, Robert Rausch and Alan Courtright. At various times additional assistance was provided by personnel from the Enforcement section at Fairbanks and the Cooperative Wildlife Research Unit at the University of Alaska.

The movements and behavior patterns of the calving segment of the Steese-Fortymile caribou herd create the necessity for three phases of field work. The first phase is intercepting the movement north and west across the Steese Highway when it is possible to obtain pre-calving herd composition data; the second phase is observing and studying the actual calving phenomenon wherein initial productivity data, the pattern of

calving and cause of mortality can be determined; and the third phase is intercepting the return movement to summer ranges south and east across the Steese Highway which affords post-calving information on herd composition, calf survival, and numbers. In order to obtain the information outlined above, complementary air and ground surveys were conducted during the period May 1 to June 15.

Ground Surveys

Ground surveys were made in three locations. The movement to the calving grounds was intercepted between May 16 and 20 by two crews camped on the Steese Highway between 12 Mile Summit and Eagle Summit. Sex and age composition of that portion of the herd moving to the calving grounds, and the ratio of cows with and without antlers was determined. A two man ground crew, flown to and from the calving grounds by helicopter, spent the period May 24-27 obtaining information relative to herd composition, pattern of calving, and calf mortality. A limited calf tagging program was also accomplished. Two crews on Eagle Summit between June 8 and 15th obtained total counts, sex and age ratios, and calf mortality information as the caribou left the calving grounds and moved across the Highway towards their summer ranges.

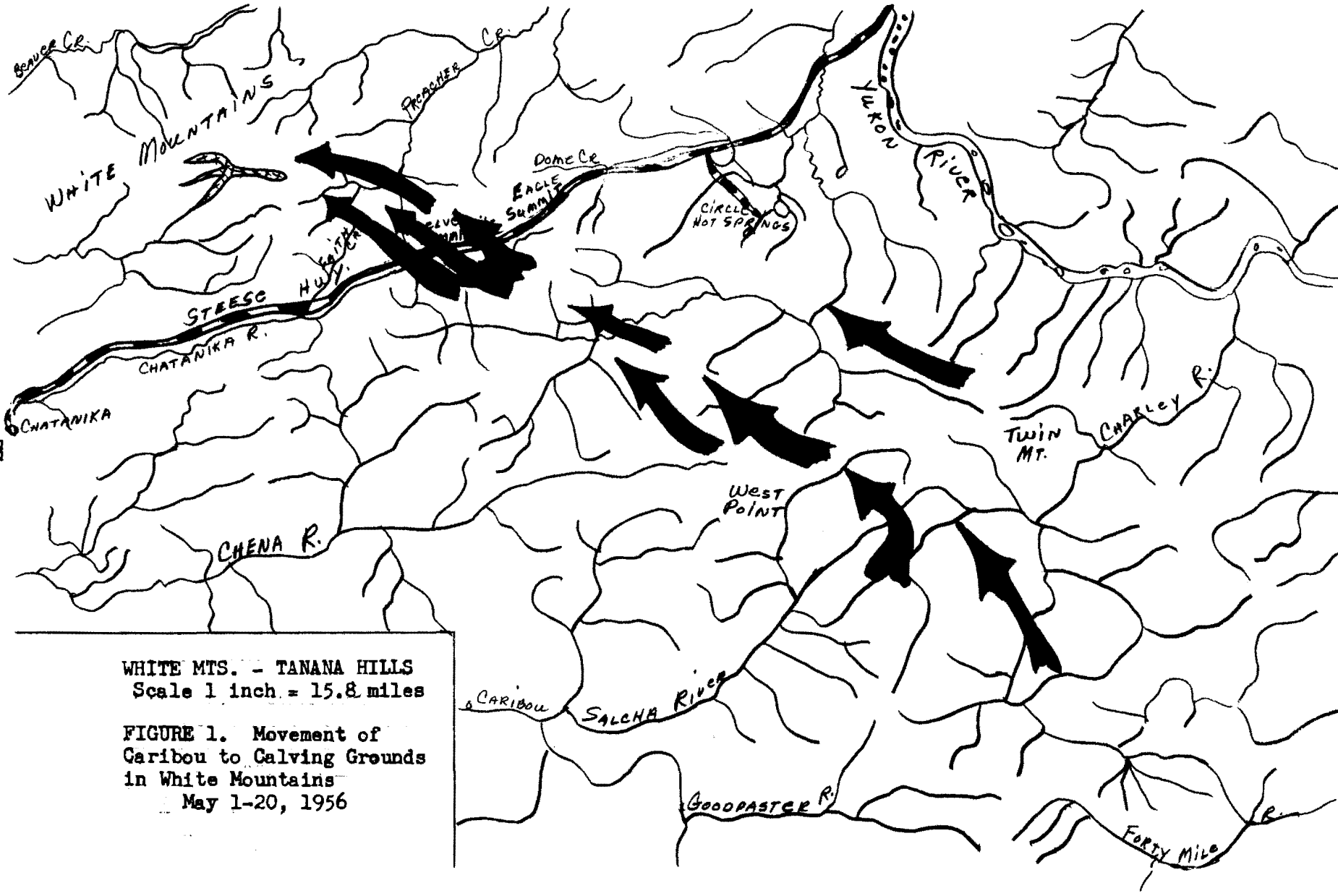
Aerial Surveys

Reconnaisgance flights during the first two weeks of May primarily traced the movements of the caribou to the calving grounds. Between May 19 and June 7, aerial tallies of large samples of calves and adults were made every one or two days, depending on the weather, to determine the pattern of calving, the location of calving and size of the calf crop. Flights made June 8-15 served as liaison between air and ground crews to follow the progress of the movement from the calving grounds across the highway.

Whenever possible, daily sample counts of 1000 animals per day, including calves, were made. Adults included all animals other than new calves. The daily samples consisted of sub-samples of 50 in order to permit calculation of the reliability of the mean calf ratio. The counts were made in such a manner over the calving area as to sample all portions of the herd as nearly proportionately as possible.

PATTERN OF CALVING

Migration to the Calving Grounds: Aerial reconnaissance on May 8 revealed many scattered small bands of cow and yearling caribou moving north and west from the headwaters of the Salcha and Charley Rivers toward Birch Creek. By May 15, they massed into large groups (up to 500) and crossed the Steese Highway between Twelve Mile and Eagle Summit until May 20, Figure 1.



WHITE MTS. - TANANA HILLS
Scale 1 inch = 15.8 miles

FIGURE 1. Movement of Caribou to Calving Grounds in White Mountains May 1-20, 1956

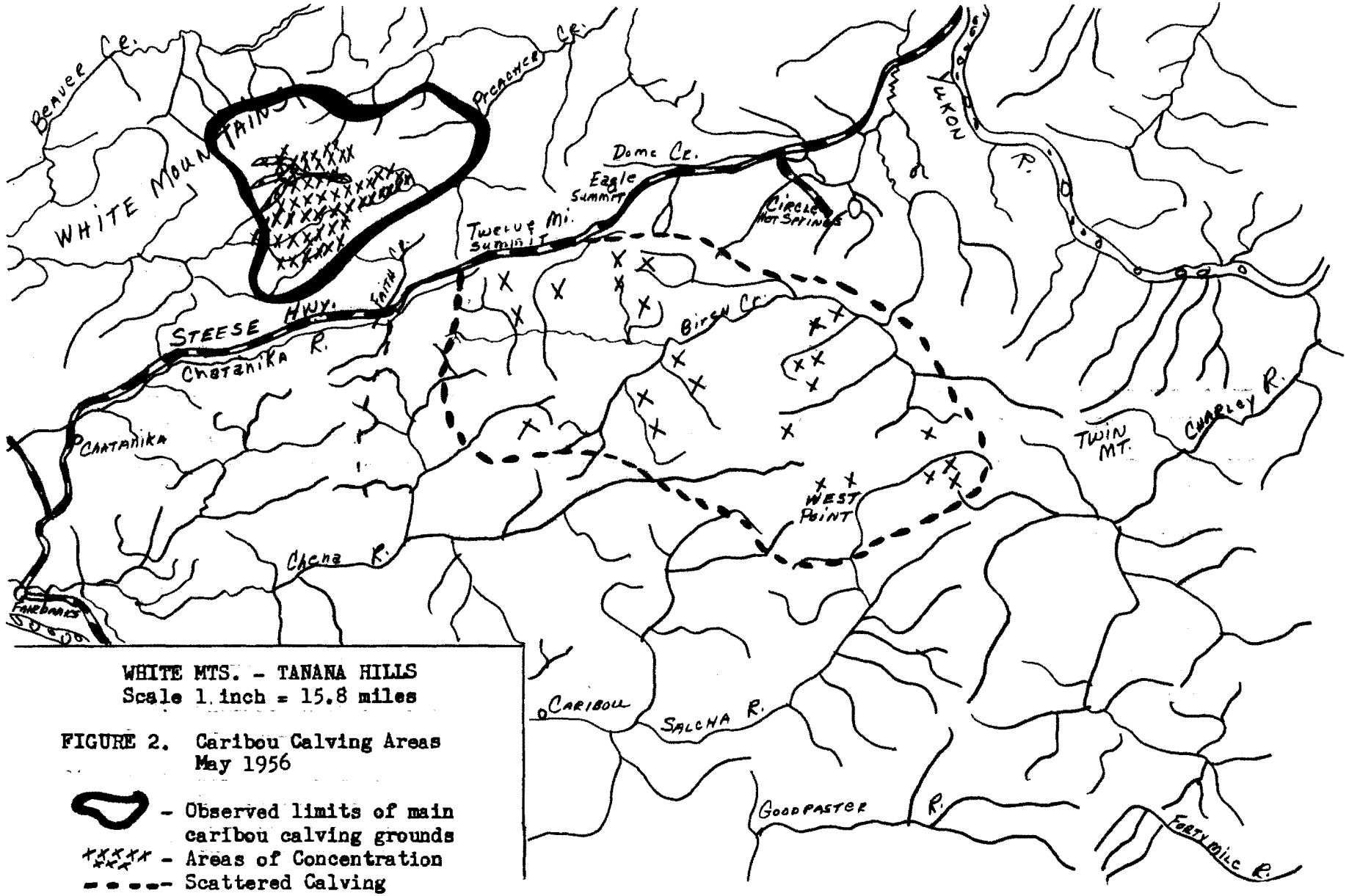
The main area utilized for calving extended generally over the area between the headwaters and tributaries of Preacher and Beaver Creeks. Within this area, the upper hills and ridges of Bear Creek, Quartz Creek, and Champion Creek had the largest concentrations of calving caribou. Not all the caribou crossed the Steese however. A flight on May 28 revealed that a considerable number of caribou were thinly spread out over the upper drainages of the Chena River, Salcha River and Birch Creek. These groups were mixed containing bulls, cows and calves, and yearlings. It was obvious that this was not a primary calving area, but evident that calving was not limited to that area north of the highway. Due to the late date of discovery and since this was not a major calving area, no attempt was made to include it in the daily calf counts or to make composition counts. The known calving areas as described above are depicted in Figure 2.

Composition counts on 1286 caribou were obtained by ground crews as the caribou crossed the Steese Highway between May 16 and the 20th. Well worn trails indicated that large numbers of caribou had crossed prior to the arrival of the ground crews. Since the caribou crossed on a 20 mile front, it was not possible to obtain total counts, therefore the only tallies made were on bands where complete composition counts were available. In addition to adults and yearlings, cows with and without antlers were recorded. These data are presented in Table 1.

Composition of calving groups: Yearlings comprised 12.9 percent of the caribou counted. This is slightly lower than 13.6 figure obtained in 1955 on the calving grounds, however not significantly different. The remaining 87.1 percent were cows. No bulls were recorded. The only comparable counts made during this period were obtained in 1953 by Skoog and Glaser and, as indicated in Table 1, are similar to 1956 counts. For all practical purposes the ratio of cows to yearlings does not vary significantly. The composition counts obtained therefore at this time, though somewhat limited, can be deemed representative for the calving groups north of the Steese as a whole.

The percentage of cows with antlers dropped steadily from 64.2 percent to 46.3 percent during the time the counts were made. This may be because the count was taken from the rear portion of the herd crossing the highway. It may also indicate that the early migrants contain a larger portion of the calf producing cows, assuming that antlered cows are pregnant and antlerless cows are not.

Progression of Calving: The progression of calving was determined by aerial calf counts which depicted the onset, peak, and decline of the calving activity. During the period of calving, there appeared to be three phases. The first phase, lasting until approximately May 20, was characterized by the movement into the area. At this time, the cows,



WHITE MTS. - TANANA HILLS
Scale 1 inch = 15.8 miles

FIGURE 2. Caribou Calving Areas
May 1956

- Observed limits of main caribou calving grounds
- Areas of Concentration
- Scattered Calving

Table 1. Composition Counts of Caribou Crossing Steese Highway Enroute to Calving Grounds in the White Mountains - May 16-19, 1956

Date	Total No.	Yearlings		Cows		Cows w/antlers		Cows w/o antlers	
		No.	%	No.	%	No.	%	No.	%
May 16	279	47	17.9	232	83.1	149	64.2	83	35.8
May 17	481	60	12.5	421	87.5	266	63.2	155	36.8
May 18	406	43	10.6	363	89.4	195	53.7	168	46.3
May 19	120	12	10.0	108	90.0	50	46.3	58	53.7
TOTALS	1286	162	12.9	1124	87.1	660	58.7	464	41.3

		Adults	
1953(1)	1336	166	12.4	1170	87.7
May 8-19	1350	195	14.4	1255	85.6

1954 Information not available for this period

1955 Information not available for this period

(1) Adults not sexed, however subsequent counts recrossing highway indicated only .3% bulls, therefore these adults are presumed to be principally cows.

yearlings, and non-producing cows were still a relatively heterogeneous group and segregation was not readily apparent. By May 21, the second phase had begun. The caribou had spread out over the calving ground, large groups had broken up and movements became localized. At this time, it became apparent that two areas of different calving intensity could be distinguished. Around the periphery of the calving range, the calving activity was considerably less since there was a greater percentage of yearlings and non-producing cows that seemed to drift out of the central areas of higher calving intensity. These two areas have been designated as "fringe" and "center" areas. This stage remained in evidence until May 27-29 after the peak of calving and the caribou began to regroup and drift out of the area. Phase three then came into being. The "fringe" and "center" areas of calving disappeared as the caribou formed into larger bands and began their movement out of the calving areas.

The first evidence of calving was noted on May 19 and by June 2nd or 3rd, was largely over with. The aerial counts summarized in Table 2 reflect the three phases outlined above. Each day, except May 24 when fog prevented coverage of the center areas, sample counts of equal size were taken from the "fringe" and "center" areas. On May 19 and 31, and June 2, 4, and 7, there was no apparent difference in the two counts and therefore are shown as one count on these dates. The counts in the "center" areas show a continuous strong upward trend of calf production until May 29 as contrasted with the "fringe" areas which not only have a considerably lower rate of calving but also a fluctuating pattern of calving. The pattern of calving as reflected by the percent of adults with calves is presented graphically in Figure 3. It tends to show that if the counts are lumped together, that is, the "fringe" and "center" areas combined, it does not give a wholy true picture of the pattern of calving, but rather reflects the fluctuation in the "fringe" areas as opposed to the relatively steady rise in calf productivity shown in the center areas. It would seem then, that the center counts are the most ideal. This requires, however, that the observer be able to differentiate between the fringe and center areas. This can be done by plotting the location of the counts in reference to the calving area as a whole.

The counts in the fringe areas, however, serve a definite purpose in that they help to complete the picture by showing the movement of yearlings and non-producing cows out of the center areas during the period of heaviest calving activity. When the fringe, as such, is no longer evident, it indicates that calving activity is decreasing and the regrouping characteristic of phase three is occurring. The fluctuation in the fringe counts apparently indicates that the composition in those areas is extremely variable as compared to the center areas, probably due to increased mobility of the larger proportion of yearlings and non-producing cows found there. While the center areas of calving activity are relatively localized, the fringe areas seem to be somewhat

Table 2. Aerial Calf:Adult Counts - Steese Fortymile Caribou - 1956 Calving season May 19-June 7, 1956. (1955 data included for comparison)

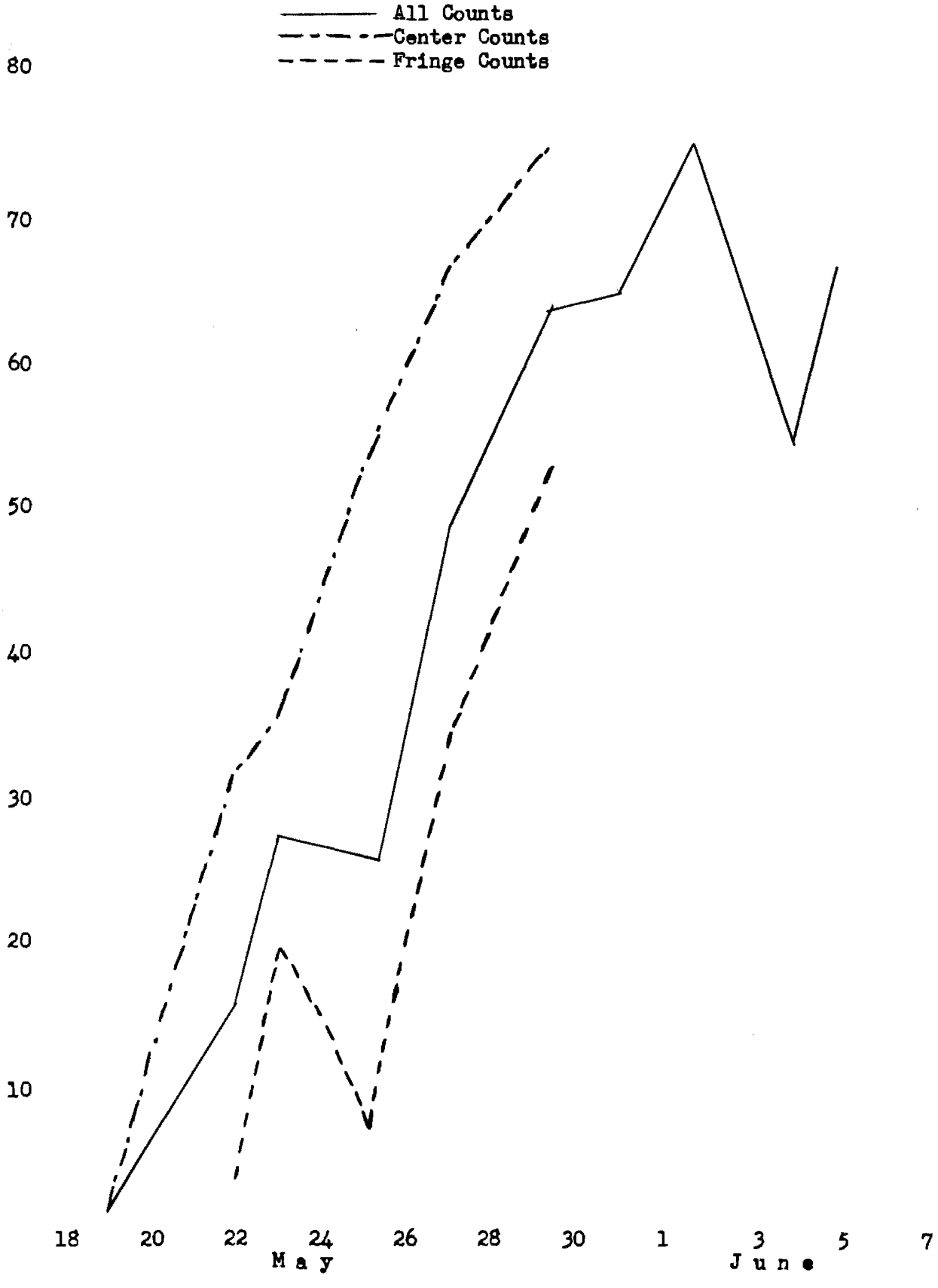
Date	Total Adults		Total Calves		Percent Adults With Calves	
	Fringe	Center	Fringe	Center	Fringe	Center
5/19(1)	--	985	--	15	--	1.5
5/22	482	373	18	117	3.7	31.4
5/23	418	369	82	131	19.6	35.5
5/24(2)	876	--	124	--	14.2	--
5/25	234	164	16	86	6.8	52.4
5/27	372	301	128	199	34.4	66.1
5/29	327	286	173	214	52.9	74.8
5/31(1)	--	425	--	275	--	64.7
6/2(1)	--	286	--	214	--	74.8
6/4(1)	--	649	--	351	--	54.0
6/7(1)	--	601	--	399	--	66.4

	Adults	Calves	Percent Adults with Calves
1955			
5/22	600	32	5.0
5/24	600	54	8.2
5/31	600	372	62.0

(1) No "fringe" or "center" areas discernable.

(2) No count in "center" due to local fog conditions.

Figure 3. Percent of Adults with Calves - Steese Fortymile Aerial Calf Counts -- 1956



mobile, that is, the size and conformation of the fringe area changes as well. It is, therefore, only possible to delineate it from day to day based on counts and general observations.

Calving began, as noted earlier, on the 18th or 19th, reached its peak between the 21st and 23rd, and was practically over by June 2nd or 3rd. After May 29th, the calf:adult ratio began to fluctuate. It is believed that had composition remained constant, the final ratio would have been approximately 65 calves to 100 adults.

Since the "fringe" area counts lacked continuity and consistency, the pattern of calving is based on the counts from the "center" areas and the counts made on May 19 and 31, and June 2, 4, and 7 when the fringe was not discernable. By May 19th, 3 percent of the calves had been dropped, by the 22nd, this figure had risen to 48 percent, and by the 25th, 80 percent of the calves had been born.

Table 2 is represented graphically in Figures 4 and 5. They illustrate more clearly the rise, peak, and decline of calving activity. Most apparent, is the fact that once calving has started, it rises to a climax very swiftly, a matter of only three or four days at best. The rate of calving drops quickly for a day or two and then decreases more slowly. The calving period in its entirety may be spread out over a months period as evidenced by Skoog's records of new calves being observed as early as May 9th in 1953 and as late as June 16th in 1955. However, the majority of the calves are dropped in a 10 day period between May 19-20 and June 1-2.

The peak of calving in 1956 is a week earlier than the peak established in 1955. This is probably the result of a better sample, improved techniques of counting, and using only the "center" counts. Counts obtained in 1955 were too inadequate to actually establish a peak with any degree of certainty. Thus, the two years are essentially not comparable.

Ground composition counts on 997 caribou made May 25-27 are presented in Table 3. They indicate a lower calf:adult ratio than the aerial count for the same period, very probably due to the fact that the ground crew was unavoidably located closer to the fringe than the center area of calving. Caribou moving through the area constantly and the failure of the calf:adult ratio to increase, are further indications the ground crew was not observing the center concentrations but probably parts of both. Composition counts made on the ground on 689 animals (excluding calves) indicate that herd composition was quite similar to 1955. The comparison of composition counts for 1955 and 1956 is presented in Table 4. The percent yearlings and yearling:cow ratio are only one percent higher than those recorded as the herd crossed the highway to the calving grounds.

Figure 4. Progress of Calving - Steese Fortymile Herd, 1956.
(Points represent actual counts)

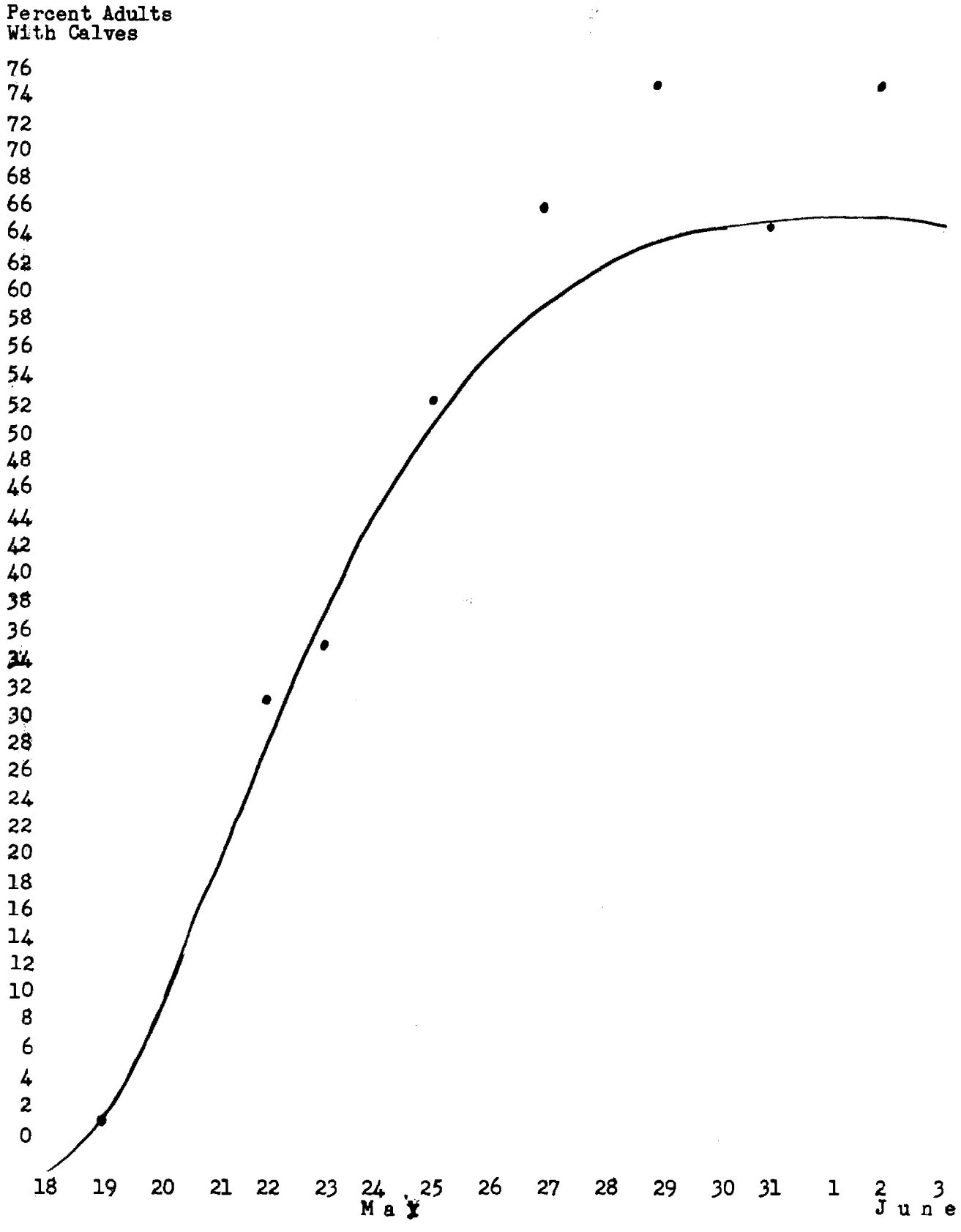


Figure 5. Daily Increment - Calves per 100 Adults
Steese Fortymile Herd — 1956

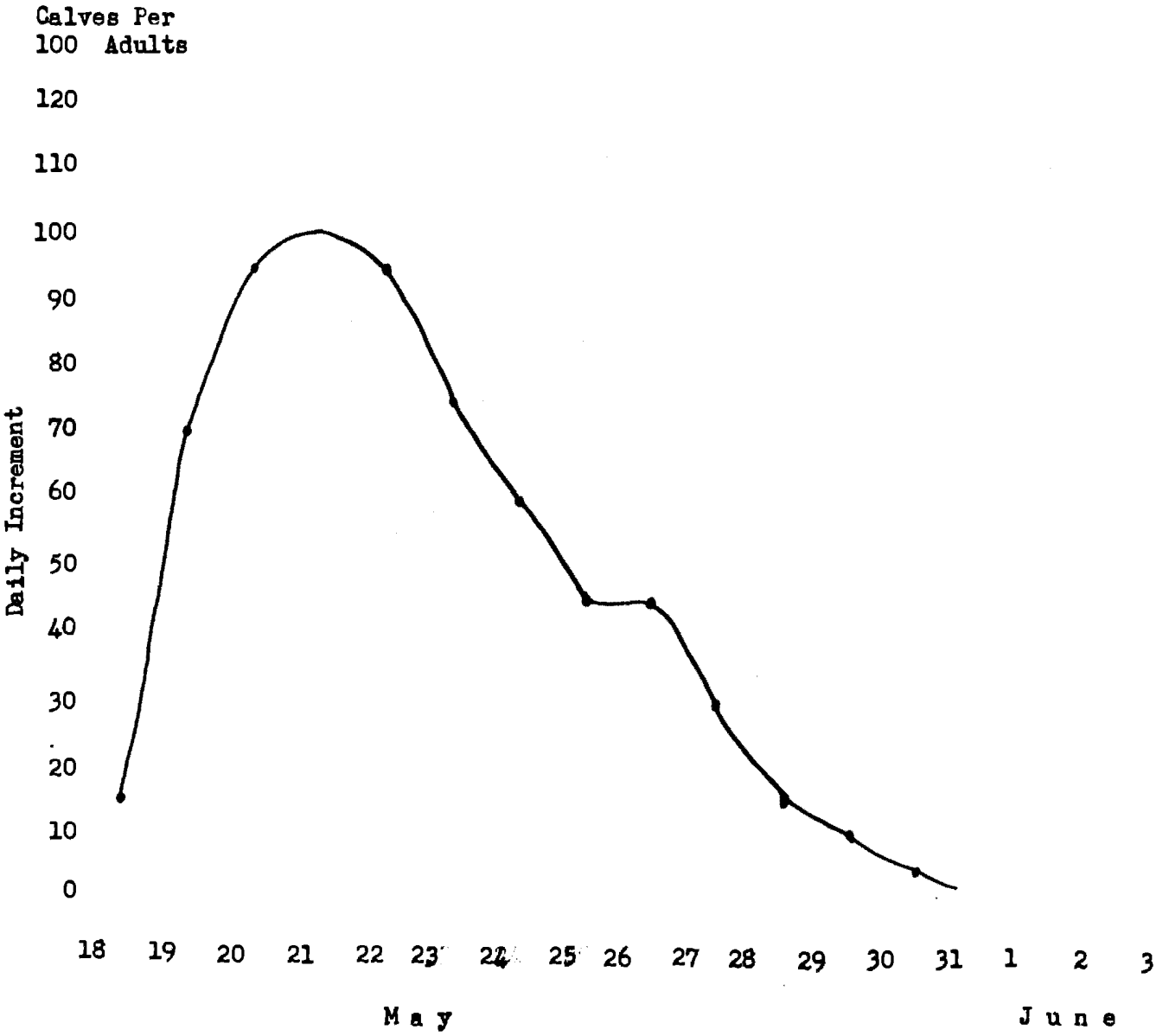


Table 3* Daily Caribou Composition Counts at Head of Quartz Creek - May 25-27, 1956

Date	Total Caribou	Calves		Yearlings		Cows			
		No.	%	No.	%	No.	%	No. with Calf	
5/25	325	108	33.3	28	8.6	189	58.1	57	16:100
5/26	302	95	31.4	31	10.2	176	58.2	54	18:100
5/27	370	106	29.7	39	10.5	225	60.8	47	21:100
Total	997	309	31	98	9.8	590	59.0	158	

* Only 1 bull seen.

Table 4. Caribou Composition Counts (Excluding Calves) Taken on Calving Grounds - 1955 and 1956

Class	1955		1956	
	No.	%	No.	%
Yearling	93	13.6	98	14.3
Cow	591	86	590	86
Bull	0	0	1	.2
Total	684	100.0	689	100.0
Yearling:Cow Ratio	16:100		16:100	

Based on this data, it can be assumed that of all animals classed as adults on the calving grounds 86 percent were cows and 14 percent were yearlings. Only one bull was recorded. The above data is substantiated by the composition of the groups moving into the calving grounds May 16-20, Table 1.

Initial Calf Crop: The best index to the initial size of the calf crop seems to be the final calf:cow ratio calculated from the aerial counts made during calving. This figure should be comparable from year to year on the calving grounds since experience has shown, that for all practical purposes, there are no adult bulls found on the calving grounds with the young stock and adult cows. The writer does not believe it is possible to accurately identify two year old cows, therefore the only categories that can be used for segregation or composition counts are calves, yearlings, and adult cows. By using the final calf:adult ratio (65:100) from the aerial counts and the yearling-cow percentages (14 and 86 percent) deemed representative of the adult portion of the herd on the calving grounds, the calculated calf:cow ratio becomes 75:100. This figure thus represents the initial survival and serves as an index to productivity.

Similar data from prior years indicates little variation in the ratios for the initial calf crop. In 1953, the percent of cows with calves was 73 percent; in 1954, 72 percent; in 1955, 72 percent. It appears that normal initial productivity then lies generally between 70 and 75 percent. It should be pointed out that all cows over the yearling class do not bear calves. Present data indicates that many two year old cows do not breed successfully, therefore the actual percentage of cows with calves is undoubtedly considerably higher than 70 percent. Present techniques do not permit segregation of two year old cows from adults, however.

Antlered vs Antlerless Cows as a Measure of Initial Productivity or Survival of Calves

For the third year, tallies were kept of antlered vs antlerless cows. As usual, only complete counts of bands were recorded. This was actually done two times this year; once as the herd crossed the Steese enroute to the calving grounds and once on the calving grounds. The first tally is presented in Table 1. As pointed out earlier, the percent of antlered cows dropped steadily each day suggesting that these counts came from the rear of this segment of the herd. It is thought that if earlier counts had been possible the figures would have been more in line with those obtained on the calving grounds a little later. There again seems to be a close relationship between the percent of antlered cows and initial calf production or survival. This is shown in Table 5. The calf:cow ratios

for 1955 and 1956 are those calculated under the "size of calf crop" section of this report, and the ratio for 1954 is taken from previous Quarterly Progress Report (Vol. 10, No. 1, pp. 14). There is definitely a possibility that the percentage of antlered cows prior to calving may furnish an index to current calf production immediately prior to the calving season. A particular effort will be made during the 1957 calving studies to obtain additional information on this particular phase.

Table 5. Relationship of Antlered Cows on the Calving Grounds to Initial Calf Production

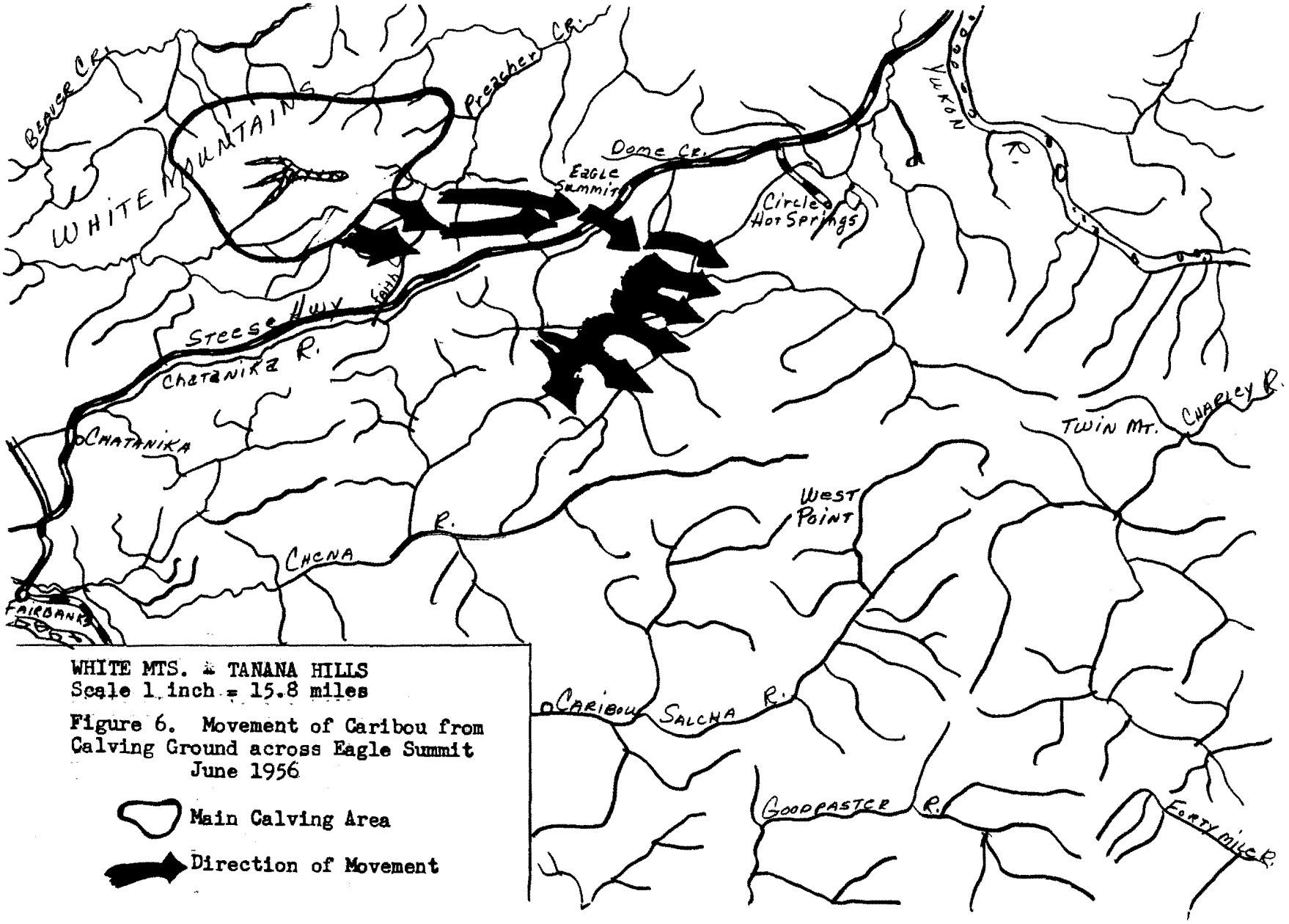
Calving Ground Tallies	1954	1955	1956
Total Cows Tallied	1066	282	590
Cow w/antlers	766	200	439
% cows w/antlers	73.8	70.9	74.4
Initial calf:cow ratio	74.9	72.0	75.0

HIGHWAY CROSSING

On June 7 a flight over the calving grounds revealed that a large number of caribou (7-10,000 adults) were grouped about 20 miles northwest of Eagle Summit. Another loose concentration (3-4,000 adults) were spread over the Faith, Nome and South Fork of Preacher Creek drainages. Five to six hundred caribou were located immediately northwest of 12 Mile Summit and a few bands had already crossed Eagle Summit. Robert Weedon, of the University of British Columbia, who was conducting a ptarmigan study in this area at this time, stated that approximately 1,000 had crossed prior June 8 when the ground crews began counting caribou as they crossed Eagle Summit. By June 16th, 29,718 caribou had been accounted for. The movement was very determined and possibly would have been completed several days earlier if the many tourists and photographers had not been chasing them back from the road. The above movement is shown in Figure 6.

Ground crews patrolling the highway by car between mileposts 105 and 110 made the following tallies:

1. Number of calves vs total animals
2. Complete counts of bands wherever possible to obtain composition counts



WHITE MTS. & TANANA HILLS
Scale 1 inch = 15.8 miles

Figure 6. Movement of Caribou from Calving Ground across Eagle Summit June 1956

Main Calving Area

Direction of Movement

3. Total counts of all animals crossing

These data were to provide information on current calf production (after early mortality), calf mortality and total number of caribou north and west of the Steese Highway.

The crossing seemed to consist of two segments. The first and largest segment, preceeded by a few yearlings, cows (mostly without calves), and an occasional bull on June 8, crossed between June 9 and 11. This segment contained 18,377 animals or 73 percent of the total crossing. The next two days, June 12 and 13, 1,189 or 4 percent crossed. During this time the remaining caribou were bunching up north of Eagle Summit and on June 14 and 15, 6,835 or the last 23 percent crossed the highway. A summary of the daily counts of caribou crossing the Steese is presented in Table 6. With the exception of the few straggling groups which crossed on the 8th and on the 12th and 13th, the caribou moved in larger more compact groups than was the case in 1955. There was no apparent difference in the composition of the two main groups. Because of the determined nature of the crossing and the size of the crossing herds, it was not possible to obtain accurate composition counts beyond determining the adult:calf ratios and the number of bulls seen. The only actual tally presented is calves, bulls and adults. The proportions of cows and yearlings are calculated. The yearling percentage is assumed to be 13.7 percent based on ground counts as the herd went to the calving grounds (12.9 %) and from counts made on the calving grounds (14.0 %).

It can be assumed that the percentage of yearlings did not change north of the highway since there was no appreciable movement of caribou into the calving area after May 19th or 20th. Thus, when the caribou moved out of the calving area the ratio of yearlings to adults should not have changed significantly. The number of bulls north of the highway was not significant in relation to actual numbers amounting to only .3 percent (32 bulls actually tallied). By subtraction then, the remaining animals had to be cows two years or older comprising 86 percent (9,220 individuals) of the adult animals actually counted across the highway. By applying the above percentages to the actual number adult animals counted and in turn calculating the percentage of the total animals including calves, it is possible to establish the herd composition of the animals crossing southward over the Steese Highway. Fourteen percent of the animals or 1,501 caribou were bulls and yearlings and 86 percent thus were cows. The herd composition of caribou crossing the Steese from the calving grounds is presented in Table 7.

The current calf crop at this date appears to be about the same as recorded for 1955, however not on a par with 1954. The comparison of herd composition (herds on the calving grounds) for 1954, 1955 and 1956 is presented in Table 8.

Table 6. Daily Total Counts of Caribou Crossing Steese Highway
June 8-15, 1956

Date	Actual Count			Estimated Counts (less calves)	Estimated No. Missed (less calves)	
	Total	Calves	Adults			
6/8	104	1	103	500	750	
6/9	2605	336	2269	1600		
6/10	2834	710	2124	1500		
6/11	6284	2608	3676	1200	1000	
6/12	616	117	499		25	
6/13	259	84	175			
6/14	1372	478	894	3000		
6/15	1633	652	981			
						Total
Totals	15,707	4,986	10,721	7,800	1775	25,282 + 4,436(1)
					Grand Total	29,718

(1) Calculated number of calves for "est. count" and "est. missed". This figure based on ratio of calves to adults actually counted (4,986 : 10,761)

Calves = 31.7 % of total (Actual counted)

" = 47 calves : 100 adults

" = 54 : 100 cows

Table 7 Herd Composition of Caribou Actually Counted Crossing Steese June 8-15, 1956

Class	Total	Calves	Adults	Yearlings*	Bulls*	Cows*
Calf	15,707	4,986	10,721	1,469	32	9,220

*Yearlings 13.7)
*Bulls .3) from ground counts of caribou enroute to the calving grounds and on the calving grounds.
*Cows 86.0)

47 calves/100 adults

54 calves/100 cows

16 yearling/100 cows

*Yearling 13.7 percent of total adults (excluding calves)
*Cows 86.0 " " " " .
*Bulls .3 " " " " .

*Yearling 9.4 percent of total animals (including calves)
*Cows 58.7 " " " " " "
*Bulls .2 " " " " " "
Calves 31.7 " " " "

100.0

Table 8 Composition of Caribou North of the Steese Highway During the Calving Periods 1954, 1955, 1956 (Based on counts as they crossed the highway leaving the calving grounds)

Class	1954	1955	1956
Calves	37.2	29.6	31.5
Yearlings	11.0	7.4	10.6
Cows	51.3	62.9	58.7
Bulls	.5	.1	.3
Calf:cow	72.5	55.2	54.0
Yearling:cow	21.4	11.8	16.0

FINAL CALF CROP

Because of the unique pattern of movement across the Steese Highway characteristic of the calving segment of the Steese Fortymile herd, it is possible to determine the final size of the calf crop with comparative facility. As shown in Table 6, 4,986 calves were actually counted across the highway and constituted 31.7 percent of the total number of individuals counted. Estimates amounting to 7,800 adult caribou were made on groups crossing where it was not possible to count each animal. In addition, an estimated 1,775 caribou were missed in the count (determined by reports from persons who had encountered caribou not tallied by FWS crews). This amounted to 9,575 adults less calves. By applying the known calf ratio obtained from actual counts to the estimated figure assuming the herd composition remained relatively constant, an additional 4,436 calves were accounted for, bringing the total number of calves crossing the Steese to 9,322. It has been shown that a considerable number of caribou did not cross the highway to calve, exactly how many is not known. It is safe, however, to assume that the total minimum calf crop for the Steese herd was in the vicinity of 10,000 calves as of June 15.

TOTAL NUMBERS

A rough approximation of minimum total population for the Steese Fortymile caribou herd can be derived from the highway counts. By using

the herd composition data in conjunction with the total number of caribou crossing the highway it is possible to calculate a minimum total figure for the herd. It must be assumed that a 100:100 sex ratio exists between adult cows and bulls. This is based on limited composition counts obtained by Skoog in 1954, and sex ratio data from hunter kills during 1954, 1955, and 1956. The calculation of the total number of caribou in the Steese herd is presented in Table 9. A minimum estimate of 45,000 is not an unreasonable figure for the Fortymile herd. It is, infact, considered to be too low, since flights over the area south of the Steese during the calving period revealed considerable numbers of caribou, largely cows, calves and yearlings, that had not crossed to the main calving area. It was not possible to obtain total counts, but it is estimated that several thousand caribou were scattered over the area. It is believed on the basis of the above calculations that the Steese Fortymile caribou herd numbers not less than 50,000 animals. This can be considered a minimum estimate.

Table 9. Estimated Minimum Total Population - Steese Fortymile Caribou Herd - June, 1956

Total caribou counted across Steese Highway, June, 1956 *29,718

Total calves (31.7%)	9422
Total yearlings (9.4%)	4071
Total cows (58.7%)	15739
Total bulls (.3%)	486
	29,718*

Assume 100:100 sex ratio cow:bulls

15,739 bulls south of highway
less 486 bulls north of highway

15,253 total number bulls. 15,253

Total caribou 44,971

*Includes 15,707 actually counted plus estimated 9,575 missed (including calves) percentages based on actual counts.

CALF MORTALITY

Calf mortality can be assessed both qualitatively and quantitatively. It was not possible to establish a quantitative measure of calf mortality on the calving grounds during the calving period, however an index to calf mortality was obtained later when the caribou crossed the Steese from the calving grounds enroute to their summer range. This was accomplished by a comparison of the initial calf:cow ratios obtained from aerial counts (May 20-June 3) as compared to calf:cow ratios obtained from counts as they crossed the highway June 10-20.

The calf:cow ratio obtained on the calving grounds just after calving was over was 75:100. (See Calf Production). Counts obtained on 15,917 caribou indicated a calf:cow ratio of 54:100. (See Highway Crossing). This indicates a drop of 21 calves per 100 cows or 28 percent. This is slightly higher than 1955. The drop of 17 calves per 100 cows or 24 percent is not significantly different to warrant any concern, Table 10.

Table 10. Early Calf Mortality as Indicated by Comparison Calf:Cow Ratios Obtained on the Calving Ground and Calf:Cow Ratios Obtained During Migration Across Steese Highway Two Weeks Later.

Period	Calving Ground (May 27-June 4)	Highway Crossing (June 9-15)	Percent Loss
1955	72:100	55:100	24%
1956	75:100	54:100	28%

Early mortality stems from a number of different causes. Still births, abandoned calves, trampling, predation, and adverse weather all are contributing factors, however their relative importance is largely unknown. During the time spent on the calving grounds 14 dead calves were observed, 8 from the air and 6 from the ground. In addition, 11 abandoned calves (one which is known to have died later) were observed. Whether all the abandoned calves died is not known, however it appeared that chances for survival looked poor.

It is believed than an unusually heavy snow storm on May 30, which covered the hills with snow to an estimated depth of 12-15 inches and with drifts from two to four feet deep, created conditions which may well

have resulted in the death of many new calves. The snow storm occurred at a period when the caribou were beginning to gather into larger groups and drift out of the area and small calves would have a difficult time bucking deep snow to keep up. All eight dead calves seen from the air were seen after this snow storm, seven of them on the calving grounds and one along the migration route. It should be pointed out that dead calves are only visible from the air when they are viewed against the snow and the snow was gone within three or four days after the storm.

Predators are omnipresent about a calving herd. Five wolves, twenty-two eagles and seven grizzlies were observed at various times. One of the bears and several of the eagles are known to be duplications. Eagles were seen in one instance attacking a calf and twice feeding on dead calves. One grizzly was observed as it carried a dead calf, another as it caught and ate a calf. The stomach contents of two grizzlies taken by hunters in the area were examined and found to contain the remains of three calves. Although wolves were seen in the area they were not observed preying on the caribou at the time they were seen. It is quite obvious that predators exact a toll on calf caribou, but how much is unknown. Observing a bear or an eagle eating a calf is not proof that the calf was also killed by either one, as both creatures are notorious scavengers. The eleven calves observed abandoned during migration are a further indication of probably mortality, however it again is not possible to determine to what extent this particular aspect is responsible.

CALF TAGGING

Eleven calves were ear-tagged during the calving studies as recorded in Table 11. No active attempt to capture calves primarily for tagging was made this year. Only those calves picked up incidentally were tagged. One of the tagged calves was abandoned by the cow and found partially consumed by ravens the next day. It is possible that several other calves tagged shortly after birth were abandoned since the cows exhibited little concern and disappeared shortly. Cows seem to have formed a stranger attachment for their offspring after several days. Two calves, two to four days old, were reclaimed by the cows immediately after being released. A third calf went immediately to its mother on being released.

To date, 55 caribou calves have been tagged over the past four years. It is interesting to note that the sex ratio over the four year period is 125 ♂ : 100 ♀.

Table 11. Record of 11 Calves Tagged on White Mountain Calving Grounds - May 25-27, 1956

Date	Tag Number	Sex	Area
5/25/56	601-602	♂	Head of Quartz and Champion Creek
	603-604	♂	" " " " " "
	605-606	♀	" " " " " "
	607-608	♀	" " " " " "
	609-610	♂	" " " " " "
	611-612	♂	" " " " " "
	613-614	♂	" " " " " "
	615-616	♂	" " " " " "
6/26/56	626-627	♂	" " " " " "
6/27/56	628-629	♀	" " " " " "
	630-631	♀	" " " " " "

Sex Ratio 175 ♂ : 100 ♀

SUMMARY

1. Calving segment of the herd moved to calving grounds in White Mountains between May 8 and 20.

2. Main calving area on divide between headwaters of Beaver Creek and Preacher Creek. Straggles calved south of highway as far south as the Salcha.

3. Composition of main calving groups 87 percent cows and 13 percent yearlings. No bulls recorded prior to calving.

4. Calving first noted May 19. Reached peak May 22 and was nearly over by June 3rd.

5. Final calf:adult ratio 65:100; final calf:cow ratio 75:100; calf:cow ratio for last four years between 70-75 calves per 100 cows.

6. Percentage of antlered cows on calving ground has approximated the initial calf:cow ratio for past three years.

7. Calving segment of herd crossed Steese Highway at Eagle Summit between June 8-16.

8. 29,718 caribou counted across highway.

9. Herd composition at the time of crossing: 31.7 calves
9.4 yearlings
58.7 cows
.2 bulls

10. Calculated minimum calf crop for Steese herd 10,000 as of June 15.

11. Estimated total herd 50,000 individuals based on highway crossing data.

12. Calf mortality 28 percent in first two weeks. Mortality due to a combination of factors. Weather during first days can be critical factor.

13. Eleven calves tagged bringing total to 55 in past four years. Sex ratio 125 ♂ : 100 ♀.

Job No. 4(a)--Management Studies of Alaska Caribou Herd
Composition Surveys--Nelchina Herd

Period Covered: March 1, 1956 to May 15, 1957

ABSTRACT

Composition counts taken during the fiscal year 1957 provided data on the sex ratio and calf survival of the Nelchina caribou herd. The following results were obtained:

1. The sex-ratio of the herd, including all animals except calves, was computed to be 76 bulls per 100 cows.

2. Calf survival during the past year to April, 1957, was estimated at 62 per cent of the total calves born during the spring of 1956.

3. Productivity data obtained reveals that 80 per cent of the adult cows (two-years-old and over) were pregnant. Some yearlings also conceive during the rut.

The data used for computing the sex-ratio and calf-survival for the Nelchina herd are filed in the Anchorage office of the Federal Aid branch.

OBJECTIVES

To determine sex and age ratios in order to ascertain calf survival and herd composition as an index to the current population status of the herd.

TECHNIQUES USED

Composition counts of Nelchina caribou during fiscal year 1957 provided data on the sex-ratio of the herd and on the extent of calf mortality. Ground counts were made in mid-October, just after the main period of the rut, while the bands still contained a high percentage of bulls. Aerial counts were made at the end of October and in early April to determine winter calf mortality; these were compared with the calving-ground data from the previous June to find the percentage of calves surviving to the yearling age-class.

The examination of carcasses throughout the year also furnished data on productivity; ovaries and foetuses were collected from cows whenever possible.

FINDINGS

Sex-ratio: Sex-ratio counts are best obtained during the rut in early October, for that is the only time the two sexes are represented

fully within the caribou groups. A large portion of the herd became accessible at that time along the Denali Highway, but the usual combination of circumstances--human, caribou, and mechanical--prevented the obtainment of significant sex data. A major movement of caribou on October 20 brought the main concentrations of the Denali area near the highway at the Maclaren River. There two observers were able to take a few counts that seemed quite representative of the hundreds streaming southward. Unfortunately, the movement lasted only one day and then the animals were beyond reach by foot. The caribou were recorded as calves, cows, or bulls, and the latter were classified as 1-2, 3-4, or over 4 years old by body and/or antler size. Young bulls (1-2 years old) were distinguished from cows by the observance of the genital organs. Only those bands that were classified completely were included in the tally. Table 1 shows the results of the counts.

Table 1. Sex-ratio counts taken of Nelchina caribou October 20, 1956, in the Denali Highway area.

Totals	Total Animals	Calves		Cows		Bulls				
		No.	%	No.	%	Total	%	1-2 Yrs.	3-4 Yrs.	5+ Yrs.
Calf	672	134	19.9							
Adult Bulls	542	97	17.9						53	44
Complete	276	56	20.3	125	45.3	95	34.4	43	27	25

Bull:Cow Ratio = 95:125 = 76:100

The data disclose a bull:cow ratio of 76:100. This figure probably is low because some bulls may have separated already from the groups counted; the old bulls (over 7 years old, or so) noticeably showed little interest in the cows any longer, and some singles were sighted that remained aloof from the bands. The small sample also could distort the ratio--for instance, the addition of only 10 bulls to the tally would raise the bull:cow ratio to 84:100. Nevertheless, the figures expressed do represent the best ones available for the Nelchina herd at present.

Some verification of the data is evident when the age classes of bulls as obtained from the counts are compared with those obtained from the examination of hunters' kills along the Denali Highway. Table 2 shows this comparison.

Table 2. Comparison of age-classes for bulls in the Nelchina caribou herd, as obtained from ground counts and hunters' kills during October, 1956

Basis for Figures	Total Bulls	1-2 Yr. Olds		3-4 Yr. Olds		Over 4 Yrs. Old	
		No.	%	No.	%	No.	%
Ground Counts	95	43	45.3	27	28.4	25	26.3
Hunter Kills	105	45	42.9	32	30.5	28	26.7

The results are close enough to suggest more than a mere coincidence. Certainly error exists both in trying to classify bulls on the hoof by age-classes and in aging the animals by tooth wear, but apparently the errors lie in the same direction and are of similar magnitude for these samples. Only an adequate sample in the future, however, can determine the validity of these sex-ratio counts.

Calf Survival: Aerial counts taken at the end of October, 1956, and in early April, 1957, provide the basis for calculating calf-survival for the year. The procedure used for these counts consisted of flying over known areas of caribou concentrations and counting only entire groups of caribou, classifying the animals as calves or adults. In the adult category, bulls four years and older were tallied also, those animals being identified by their lack of antlers or simply by antler and body size; in April, all these bulls are antlerless. Because the number of these bulls in the groups varied from one area to the next, they were eliminated from the adult total in order that the various counts could be compared directly. It was assumed that the younger bulls (three years or less) were distributed more or less equally in the various areas; these younger animals have greater tendency to stay with the bands of cows and calves than do the older bulls.

Counts on October 31 and November 1 tallied 4,902 animals in the Deadman Lake and Paxson areas; this total included 1,142 calves and 3,186 adults (minus the old bulls), for a calf percentage of 35.8 (1,142:3,186). The Deadman Lake area count totaled 1,500 animals, including 331 calves plus 1,017 adults (minus bulls)--a calf percentage of 32.5. The Paxson area count totaled 3,402 animals, with 811 calves and 2,169 adults (minus bulls) for a percentage of 37.4.

Counts on April 6 tallied 4,502 caribou in four areas: Paxson, Deadman Lake, Watana Creek, and Devil Creek. The total included 899 calves and 3,222 adults (minus the old bulls) for a calf:adult percentage of 27.9. The calf:adult percentages in the four areas varied as follows: Paxson, 29.9 (298:997); Deadman Lake, 22.7 (182:802); Watana Creek, 22.4 (123:549); and Devil Creek, 33.9 (296:874).

Table 3 lists the results of both counts. The calf percentages expressed in the totals do not represent necessarily the true proportions

Table 3. Composition counts taken in October, 1956, and April, 1957, from the Nelchina caribou herd.

Date	Area	Total Animals	Calves	Adults			Calf Percentages		
				Total	Bulls 4 Yrs./	Total Minus Bulls	Calf Total Animal	Calf Adults	Calf Minus Bulls
10/31/56	Deadman Lake	1500	331	1169	152	1017	22.1	28.3	32.5
	Paxson Lake	3402	811	2591	422	2169	23.8	31.3	37.4
	Total	4902	1142	3760	574	3186	23.3	30.4	35.8
4/6/57	Paxson Lake	1501	298	1203	206	997	19.9	24.8	29.9
	Deadman Lake	1033	182	851	49	802	17.6	21.4	22.7
	Watana Creek	748	123	625	76	549	16.4	19.7	22.4
	Devil Creek	1220	296	924	50	874	24.3	32.0	33.9
	Total	4502	899	3603	381	3222	20.0	25.0	27.9

for the whole herd. To be completely accurate the percentages should be weighted according to the number of animals in the areas covered; this latter knowledge was not known, so no attempt was made to weight the percentages obtained. The error arising as a result is not measurable with the present data.

To determine calf survival the results of the above counts were compared with the calving data obtained last spring. The final calf:cow percentage ratio for the herd as of July 1, 1956, was computed to be 60 (60 calves per 100 cows). This ratio must be changed to a calf:adults-minus-bulls-over-three-years-old ratio in order that all the counts have the same base for comparison. To transform the calf:cow figure requires some manipulation of data--1 to 3 year-old bulls must be added to the cow figure to obtain a ratio comparable to those obtained from the October and April counts. Table 1 supplies the needed sex-ratio data (assuming they are accurate), but 3-4 year-old bulls are lumped together. Table 5 in the hunters' harvest report, however, shows a 3 year-old: 4 year-old ratio among the bulls (aged hunters' kills) of 20:12. These figures, applied to the number of bulls listed in the 3-4 year-old group in Table 1 of this report, disclose that 17 of the 27 animals listed were three-year-olds. Thus, the total number of bulls in that tally, under four years old, reaches 60, compared with 125 cows in the same tally (see Table 1). This young-bull:cow ratio--60:125, or 48:100--provides the information needed for determining how many young bulls must be added to the calf:cow figures to obtain the desired calf:adult (minus bulls over 3 years old) ratio. The calf:cow:young-bull ratio becomes 60:100:48, and the calf:adult ratio, 60:148, or 40.5 per cent.

Thus, the calf:adult percentages declined from 40.5 on July 1, 1956, to 35.8 on November 1, 1956, to 27.9 on April 6, 1957. These figures indicate a calf mortality of 12 per cent (4.7:40.5) during the four-month period after July 1, and a 22 per cent mortality (7.9:35.8) during the five-month period following. The overall mortality between July 1, 1956, and April 6, 1957, is 31 per cent (12.6:40.5).

Initial calf-mortality on the calving grounds was estimated at 10 per cent of the calves born (see calving report). Transposing the calf:adult ratio of 40.5 per cent back to include <u>all</u> calf births makes the ratio 45.0--meaning that, if all the calves born had lived, there would be 45 calves to 100 adults (minus the bulls over three years old). Thus, the calf-mortality for the year can be calculated by using the initial 45.0 percentage and the final 27.9, making a total calf mortality of 38 per cent (17.1:45.0). Table 4 summarizes the determination of calf mortality as described above.

The accuracy of the mortality figures expressed remain unknown, for possible errors exist in <u>all</u> of the figures shown in Table 4. These errors arise because the bases for calculations include estimates, small samples, and unweighted percentages. Thus, the mortality figures themselves are estimates at best, based on the data available.

Table 4. Data showing calculation of calf-mortality for the Nelchina herd, as occurring between June, 1956, and April, 1957.

Date	Calf/Adult* (per cent)	Per Cent Mortality			Basis for Figures
		Periodic	7/1-4/6	Total	
Initial	45.0	Initial 10 (4.5:45.0)			Computed 10% initial calf-mortality.
7/1/56	40.5	4 months 12 (4.7:40.5)			Computed calf:cow ratio of 60:100, plus computed ratio of 48 young bulls:100 cows. (see sex-ratio data Table 1)
11/1/56	35.8	5 months 22 (7.9:35.8)			Aerial counts--1,142 calves: 3,186 adults.
4/6/57	27.9		31 (12.6:40.5)	38 (17.1:45.0)	Aerial counts--899 calves: 3,222 adults.

*Adults excludes bulls over three-years old.

Fertility Data: During 1956 and 1957 caribou were collected at various times of the year for pregnancy checks, as well as for stomach samples, weights and measurements, and other data available from the carcasses. Ovaries and foetuses were saved for later examination. The hunting season provided an excellent chance to examine carcasses, and during October, 1956, twenty-five sets of ovaries were obtained. All have been checked for corpora lutea of pregnancy; some of the animals, of course, had not yet conceived because the rut was still in progress at the time of death.

The productivity data obtained are somewhat scanty as yet, so no analysis has been attempted. Table 5, however, summarizes the information available to date on pregnancies of Nelchina caribou as related to age. The age-classes indicated refer to the age of the animal at conception. Non-pregnant cows examined during October are not included in the tabulation, because they could have conceived later.

The high percentage of adult cows pregnant is borne out by the data obtained from calving studies. The fact that two yearlings were pregnant indicates that at least some of them came in heat during the rut. Calving-ground studies, however, have not identified any such animals with calves, so probably few of the yearlings actually do conceive.

Table 5. Pregnancy, as related to age, of female caribou from the Nelchina herd--data obtained during 1956 and 1957

Age at Conception	Total No. Cows Examined	Cows Pregnant Yes	No	% Pregnant
Calf	6	0	6	0.0
Yearling	13	2	11	15.4
2 Yrs.	4	4	0	100.0
3 Yrs.	3	1	2	33.3
4-6 Yrs.	18	16	2	88.9
7-9 Yrs.	8	6	2	75.0
10+ Yrs.	2	1	1	50.0
No Age (2 Yrs.+)	6	5	1	83.3
Total	60	35	25	58.3
Adults (2 Yrs.+)	41	33	8	80.5

RECOMMENDATIONS

Sex and age composition data should be gathered annually.

Prepared by:

Ronald O. Skoog
Wildlife Management Biologist

Approved by:

Robert F. Scott
Supervisor of Game Restoration

Date: May 15, 1957

Work Plan No. B.
Job No. 4-b

Management Studies of Alaska Caribou
Herd Composition
By Sigurd T. Olson

Herd Composition

As in past years, herd composition data was obtained during October as the herd migrated across the Taylor Highway. At this time all segments of the herd are found together and the hunter kill provides the best source of information relative to sex and age above the calf and yearling age classes. Although the current kill was considerably less than in 1954 and 1955, enough information was obtained for comparison. Age ratios for the calf and yearling classes in relation to adults must necessarily be obtained from counts at other times of the year since, due to hunter preference, these two classes are not represented proportionately in the hunter take. A summary of sex and age data obtained from the checking station operated September 28 to October 10, 1956, on the Taylor Highway is presented in Table 1. Similar data for 1954 and 1955 is also presented for comparative purposes.

Age data was obtained through analysis of 181 jaws collected at the checking station from caribou two years or older. This amounted to a 30 percent sample of the total kill and is considered adequate. It was found that the ability to age caribou by checking station personnel varied considerably. The error involved in mere field examination of kills without collecting jaws was too great to produce reliable results, therefore, data from this source was disregarded.

Adult-calf ratios were obtained from ground and aerial counts made during the summer months, the highway crossing in early October and again in later October. To obtain a larger sample and to substantiate the early counts, additional calf counts were made during the following January and March when the caribou were on their winter range. A summary of these counts is presented in Table 2. Yearling counts are available only during the previous spring months just before and after calving, and are quoted from Job Plan B, Report number 3-b of this Quarterly Report.

It is not possible to determine sex and age composition for the herd as a whole at anyone time using any single set of data; therefore, the various sets presented will be evaluated separately as well as in relation to one another as much as possible.

Sex Ratios

The caribou crossed the Taylor Highway during the rutting season and is reflected in the adult sex ratio of 150 ♂ : 100 ♀ as compared to

Table 1. Sex and Age Classification of Hunters' Kills, Steese-Fortymile Herd - 1956

AGE GROUP (YEARS)	MALE No.	MALE %		FEMALE No.	FEMALE %		TOTAL No.	TOTAL %	
2	7	6.5)		9	12.4)		16	8.8)	
		)27.8			)37.1			)31.4	
3	23	21.3)		18	24.7)		41	22.6)	
4-6	60	55.5		31	42.4		91	50.3	
7-9	18	16.7		10	13.7		28	15.5	
10+	0	--		5	6.8		5	2.8	
	108	100.0		73	100.0		181	100.0	
	60%			40%					
	148 ♂ : 100 ♀								
HUNTERS' KILLS SEXED	364	59.0		243	41.0		607	--	
	150 ♂ : 100 ♀								
CALVES	2	40.0		3	60.0		5	--	
YEARLINGS	3	50.0		3	50.0		6		

Continued next page

Table 1 - continued

Age and Sex Classification of Hunters' Kills 1954 and 1955, From the Steese-Fortymile Herd.

AGE GROUP (YEARS)	1954						1955					
	MALE		FEMALE		TOTAL		MALE		FEMALE		TOTAL	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
2-3	44	69.8	39	54.2	83	61.5	147	52.9	116	46.4	263	29.8
4-6	13	20.7	21	29.1	34	25.2	104	37.4	86	34.4	190	36.0
7-9	5	7.9	10	13.9	15	11.1	27	9.7	45	18.0	72	13.6
10+	1	1.6	2	2.8	3	2.2	0	0.0	3	1.2	3	0.6
TOTAL	63	46.7	72	53.3	135		278	52.7	250	47.3	528	
HUNTERS' KILLS SEXED	462	49.7	267	50.3	929		773	52.3	704	47.7	1477	
	99 ♂ : 100 ♀						110 ♂ : 100 ♀					
CALVES	22	57.9	16	42.1	38		31	63.3	18	36.7	49	
	137 ♂ : 100 ♀						172 ♂ : 100 ♀					
YEARLINGS	-	-	-	-	-		31	46.3	36	53.7	67	
							86 ♂ : 100 ♀					

110 ♂ : 100 ♀ in 1955 and 99 ♂ : 100 ♀ in 1954. It is thought, however, that this is more a function of hunter selectivity than the actual sex ratio since bulls were more available than in the two previous years. In 1954, the major kill preceeded the rut and in 1955 it came just after the rut. Yearling and calf sex ratios from the hunter take are based on too scanty data to draw any conclusions for 1956, however, they have been included and serve to substantiate, in some measure, the ratios noted in 1954 and 1955 for yearlings and calves. There seems to be no reason to change the standing assumption, in view of the light hunting pressure exerted, that the probable overall sex ratio is somewhere in the neighborhood of 100 ♂ : 100 ♀.

Age Ratios

Hunter selectivity favoring bulls with larger antlers has injected an element of bias into the age structure of this segment of the population. These animals fall mostly in the 4-6 year age class and, as shown in Table 1, are not comparable to the same age class for cows. There is little chance, on the other hand, that the hunter can distinguish cows in a similar manner since antler development is too varied. It is believed, therefore, the age structure revealed by analysis of the female jaws is the more reliable index for the adult segment of the herd. Discussion of adult age ratios will thus be restricted to those shown by the female segment of the population and it is assumed that it is representative of the herd as a whole.

When compared with similar data from 1954 and 1955, a gradual trend towards an older average age is becoming apparent as shown by the progressive weakening of the younger age classes (2-3 years) and strengthening of the 4-6 and 7-9 year age classes in the last three years. In the 2-3 year class, the percentage has dropped from a high of 54.2 in 1954, to 46.4 in 1955 and 37.1 in 1956. The percentage in the 4-6 year class has risen from 29.1 in 1954, to 34.4 in 1955, to a high of 42.4 in 1956. The 7-9 year has remained about the same the past two years, while the 10+ year class increased somewhat in 1956 over 1954 and 1955. This seems to be indicative of a stabilizing population.

Calf:adult ratios for 1956-57, presented in Table 2, reveal that calf survival has been extremely low as compared with similar data for 1955. Counts conducted during the summer indicated the probability of a partial calf failure, however it was felt they were too limited in scope to draw any significant conclusions. Continuing counts during the fall and winter, however, seemed to confirm these earlier suspicions. The counts were made from portions of the herd widely enough separated and at times that insured no duplication.

There was no reason to believe that the calf crop was less than normal when assessed in June (see section on "Calving"), however, the four percent figure obtained from the fall and winter counts leaves no doubt that a significant loss of calves must have occurred during the intervening period when compared to similar counts made during 1955. (These are the only counts available that are directly comparable since the entire herd is found together at this time.)

The calf mortality is graphically illustrated by comparing the 1956 post-calving calf:cow ratio with the calf:cow ratio six months later. If we assume an adult sex ratio of 100 ♂ to 100 ♀, then the calf ratio of 4 calves:100 adults (four years or older) becomes 8 calves:100 ♀. The post-calving ratio in June was 54 calves:100 cows as compared to 8 calves:100 cows by the end of the year or a loss of 85 percent during the summer months. In 1955, the calf:cow ratio had dropped from a post-calving high of 55:100 to 44:100 by mid October, a difference of only 20 percent as compared to 80 percent in 1956.

This is the most significant information obtained from the present investigation of herd composition. It is still too early to determine the end results of the apparent poor calf survival in 1956, however, if we assume that there is no gain or loss of individuals in the herd due to emmigration or immigration the effect will become manifest within the next two years. An extremely weak two year age class will be the first effect followed by a correspondingly small contribution toward the annual increment as this particular class reaches breeding age. Should this situation reoccur for two or more consecutive years, this particular herd of caribou will exhibit a sharp decline in numbers. A final check on calf survival will be possible when the cows and yearling move to the calving grounds north of the Steese Highway in May.

The above phenomenon may well tie in with the apparent shift in age towards a higher percentage of older age animals as shown by the analysis of adult jaws. These perhaps are the first signs of a change in the status of the present Fortymile caribou herd.

Theoretical Age Composition

Age composition for the herd as a whole, as of October 1956, can now be determined using known ratios and percentages based on a theoretical herd of 1000 individuals. Four percent or 40 individuals of the herd are calves, leaving a balance of 960 animals one year or older. The only yearling ratio available (13.7 or 14 percent of total cows and yearlings; see section on "Highway Crossing") was obtained from calving ground counts. There is no reason to believe that any significant change in this ratio has occurred between June and October. Assuming a

Table 2. Summary of Adult-Calf Counts, Steese-Fortymile Caribou 1956-57 - Comparison with 1955.

DATE	METHOD	TOTAL	ADULTS	CALVES	% CALVES	CALF-ADULT RATIO
1956						
Oct. 1-3	Ground	354	339	15	4.0	4:100
Oct. 8	Aerial	156	148	8	5.0	5:100
*Oct. 15	"	227	216	11	5.0	5:100
1957						
Jan. 22	"	1146	1127	19	2.0	2:100
March 6-7	"	1013	962	51	5.0	5:100
TOTAL (Aerial)		2542	2453	89	3.5	4:100
1955						
Oct. 19-21	Ground	570	491	79	13.8	16:100
Oct. 13-14	Aerial	1089	900	189	17.3	21:100

* Counts obtained through the courtesy of William Fuller, Canadian Wildlife Service, Whitehorse, Y.T.

sex ratio of 100 ♂ : 100♀, 480 out of 960 adults one year or older would be females; therefore, by proportion if the ratio of yearlings to adult cows and yearling is 14 to 100, then there would be 67 yearlings (male and female) to 480 cows and yearlings. Again, assuming a 100 ♂ : 100 ♀ sex ratio, one half of the 67 yearlings or 33 yearlings would be females. By subtraction, there would be 447 adult cows two years or older and 33 yearling cows. Likewise, there would be 34 male yearlings and 446 adult bulls two years or older. By adding the adult segments together, there are 893 adults two years or older, Using the percentages obtained by analysis of jaws (females - see Table 1) the breakdown of this portion of the herd is derived as follows: Age 2-3, 330 individuals; Age 4-6, 375; Age 7-9, 125; and Age 10+, 63. If the numbers of individuals in each age class are expressed as percent of 1000 animals, the complete age composition of the herd is as follows: calves, 4 percent; yearlings, 7 percent; 2-3 years, 33 percent; 4-6 years, 37 percent; 7-9, 13 percent and 10 years plus, 6 percent.

Summary

1. Age ratios for adult caribou based on analyses of 181 jaws (30 percent sample) collected at checking station during late September and early October.

2. Sex ratios obtained from check of 607 hunters' kills indicate sex ratio 150 ♂ : 100 ♀, believed biased in favor of males due to hunter selectivity. Actual ratio probably about 100:100 due to light hunting pressure and either sex regulation.

3. Female jaws most reliable index to age due to less hunter selectivity.

4. Gradual trend towards stronger older age classes indicates possibility of stabilizing population during past three years.

5. Calf survival very poor in 1956 as indicated by calf:adult ratio of 4:100 as compared to 16:100 in 1954 and 21:100 in 1955.

6. Theoretical herd composition as of October: calves, 4 percent; yearlings, 7 percent; 2-3 years, 33 percent; 4-6, 37 percent; 7-9, 13 percent; and 10 years plus, 6 percent.

Job No. 5--Management Studies of Alaska Caribou--Caribou Stomach Analysis

Period Covered: July 1, 1956 - June 30, 1957

ABSTRACT

After exploring various technics, a limited number of caribou stomach samples were analyzed by an experimental procedure that appeared to yield good results. The principal difficulty to be overcome was the inability to identify at sight the minute particles of vegetation that made up the bulk of most samples. It was found that analysis based only on identification of the larger, recognizable particles was misleading in that certain forage species, especially lichens, occurred disproportionately in the smaller size classes of particles. Seasonal occurrence of recognizable forage species in the larger particles was recorded for a representative series of samples.

OBJECTIVES

To develop a suitable technic, and to analyze samples of caribou stomach contents in order to determine the relative occurrence of the various species of forage plants in the food of caribou.

TECHNIQUES USED

The analysis project has been carried out at the Alaska Cooperative Wildlife Research Unit, under the direction of Dr. John L. Buckley. Work will be continued during the coming year and a final report submitted upon its completion. This report describes progress to date.

Samples of caribou rumen contents have been collected by field personnel at various times of the year, and in different areas.

The initial requirement was for the selection, or development, of a suitable procedure for analyzing the collected samples. A number of possible methods were explored in the process of developing the technic described here.

Five samples were completely analyzed, using the following procedures: each sample was separated, by means of graduated screens, into 9 to 11 parts, depending on the number of screens available. The portion of the sample retained by a screen of a given size was termed a "sub-sample" and given a number corresponding to the number of meshes per inch in the retaining screen. The term "sub-sample" is abbreviated to s.s. in this report when referring to a specific one; thus, "s.s.4" refers to that portion of a sample retained by a screen of 4 meshes per inch, etc.

The volume of each sub-sample was obtained by displacement after draining on absorbent paper, and the volume recorded. The totals of these volumes were the basis for computing the proportion of the sample which was made up of particles of various sizes (i.e., retained by the various screens).

Sub-samples 4 and 7 were, in each case, analyzed in their entirety; that is, all of the plant particles in these groups were classified. This was also done for all except one of the sub-samples retained by a screen of 10 meshes per inch, the exception being one in which the number of particles was too large to make such a procedure practicable. In sub-sample 20 and smaller, only a portion of the particles were analyzed, the proportion decreasing as the size of the particles decreased. Thus, in s.s.200, analysis was generally confined to the particles contained in a single drop of water, or probably less than 0.05 per cent of the sub-sample, while in s.s.20 perhaps as much as 25 per cent was analyzed in most cases.

Identification was carried as far as possible in each sub-sample, but weighing and volumetric measurements were not usually carried beyond s.s.20. The amount of time involved in separating enough material to make measurements of any kind possible is prohibitive for material smaller than s.s.20; in the case of a sample of this size, the amount used to obtain comparative weights is far less than the amount needed for volumetric measurement, and even this small amount is broken down to the broad groups used only after nearly a full day of work.

Quite aside from the time involved, the difficulties of handling extremely small pieces would rule out any method of proportional measurement other than a simple count of the particles in s.s.30 and smaller.

Efforts were made to carry identification of the "most-abundant" plant groups down to as small a size as possible; in most cases s.s.30 or s.s.40 marked the dividing line for all plant groups except lichens and mosses. The former could usually be identified to s.s.60 or 80, while mosses were identifiable in all size groups.

The use of a plant stain, phloroglucinol (which is abbreviated to Phl.), was introduced at about s.s.40, replacing identification of known plant groups. Phloroglucinol is a stain specific for lignified tissue when used in combination with hydrochloric acid. The usual combination of phloroglucinol dissolved in ethyl alcohol was changed in this case to a phloroglucinol-glycerol solution; it was found that this simplified the counting procedure in the smaller size particles by greatly reducing the inevitable flowing of particles from one counting area to another. In many cases, phloroglucinol was used simultaneously with other types of identification in one or two sub-samples, thus furnishing an overlap area in which proportions of stained material could be compared with proportions of groups recognizable by other means. In this manner, trends of various groups could be at

least partly substantiated beyond the point at which any specific plant group could be certainly identified. In other words, it was judged that no plant group, not even the lichens, could be identified with absolute certainty when the particles were smaller than those found in s.s.30. Therefore, an increase in proportions of lichens beyond this point could be due to misidentification. If, however, some other group, which can be identified with absolute certainty, declines in proportion to the increase in lichens, this tends to substantiate the identification of the latter, even though the "absolutely identifiable" group is artificially induced.

Counting of particles was in some cases overlapped with weights and volumetric measurements, again in order to furnish an overlap area to illustrate that trends continue beyond the point at which it is practical to separate for weighing and measuring. In this manner it was also possible to demonstrate that weights, volumes, and counts generally become more and more comparable as the size of particles decreases. This does not mean that they always become strictly comparable, but only that they are closer to being so in the smaller size particles than in, say, s.s.7.

Two procedures, the separation of a sample into sub-samples and the measuring of extremely small volumes, required fabrication of special equipment. This required a good deal of trial-and-error inventing, with the result that an inordinate amount of time was spent on such things before the actual process of analyzing could begin. In final form, the separation apparatus consisted of a 5-gallon milk can with a suction outlet fixed to the upper portion and a drain in the bottom. The screens, stacked one on top of another, were placed on top of the milk can, with seams being covered by wide bands of inner tube. Five gallons of water could then be washed through a sample before the device needed emptying; in general, at least 15 gallons were required to wash each sample to the extent that all particles came to rest in the proper screen. The suction device was made necessary by the fact that the smaller screens were easily clogged up, even to the extent that water would not pass through them at all. This is not surprising when one considers that the openings in a screen of 100 meshes per inch are smaller than those used in screens which are often used to separate water from gasoline.

Volumetric measurements of particles or groups of particles of less than 1 ml. were simplified by using a 1 ml. pipette with 0.01 ml. graduations to draw off and measure water displaced above a line marked on a small cylinder fabricated from a section of a 10 ml. pipette. Readings could thus be obtained to 0.005 ml., which is about the volume of a single small leaf of Loiseluria.

All weighing was done on a torsion balance, which resulted in considerably less time being spent on this process than would have been possible had a chemical balance been used, though it was of course necessary to thus sacrifice a certain degree of accuracy.

FINDINGS

A significant trend was found in every one of the five completely-analyzed samples. The percentage of lichens invariably increased as the size of the particles decreased; the corresponding decrease in percentage of grass was found to hold true regardless of whether the most-abundant plant group in the largest sizes was grass, woody plants, or fungi. In one case, mushrooms and woody plants were about equally abundant in s.s.4; the proportion of both decreased as the size of particles decreased.

The above trends are not always abrupt, nor is there always an immediate difference between s.s.4 and s.s.7. Woody plants, especially, often increase between s.s.4 and s.s.7, and sometimes even to s.s.10.

With only five samples completely analyzed, it is not possible to draw any general conclusions, though some theories might be promulgated to be proven or disproven by further detailed analyses. One fact, however, can be stated here as incontrovertible, since it is easily verifiable by even a casual visual inspection of a sample: The material which is or has in the past always been used as the basis for analysis invariably constitutes less than 50% of the sample, and in many cases may make up considerably less than 25%. Frequently, s.s.100 and s.s.200 make up a rather large percentage of the sample volume, but this is due almost entirely to the presence of protozoa in these two size classes. The proportion of protozoa alone may be more than 25% by volume in a single stomach. The effect of eliminating the animal matter from calculations would be to raise the proportions of all the size classes except the two smallest, which would be lowered. Variation between samples would also be increased.

By far the largest proportion of the sample usually is made up of those particles which are considerably smaller than what is generally accepted as "identifiable." This would be less consistently true if only plant material were considered; even under these circumstances, however, it is doubtful that one sample in ten would have more than 50% of its material in sub-samples 4, 7 and 10.

The implications of such a trend in proportions should be quite clear; the grass-sedge group, which on the basis of s.s.4 would constitute more than three-fourths of the sample as compared to less than 10% lichens, would, on the basis of its percentage curve as inferred from the first five sub-samples, actually constitute less than 13% of the sample as compared to nearly 30% lichens.

Previous analyses have not, of course, been confined to particles as large as those found in s.s.4. In general, however, it is probably true that they have not included much, if any, material smaller than that which would be retained by a screen of 10 meshes per inch; adding even the material from one more screen, of 20 meshes per inch, would much more than double the time required to make a reliable analysis.

The fact that lichens, in all five samples analyzed to date, always increase while other types of plants decrease as particle size decreases indicates (though not by any means incontrovertibly, with such a small number of samples) that analysis of only those particles retained by a screen of 10 or 12 meshes per inch is not representative of the entire contents of the stomach. This does not, however, rule out the possibility that such analyses may be representative of the recently ingested materials; differential digestibility of lichens and other groups might well explain the "trends" on the basis of the facts here presented. As a matter of record, however, the writer would like to state his present belief that the differences are due to the fact that lichens, when dry, are more easily fragmented than other types of plants; other observations made in the course of the five analyses and other less detailed analyses tend to support this belief. Presentation of this supporting evidence will be made following further detailed work.

By the time five samples had been analyzed in the detailed manner described above, shortage of time made it necessary that a relatively large number of samples be at least partially analyzed in order to make the results available for field studies being conducted this summer. These "rapid" analyses were made in much the same manner as those done previous to initiation of the present study, with the exception of measurements. Rather than take the time necessary to measure volumetrically the proportions of various groups or species, the particles were dispersed in a pan of water and assigned a number based on proportion. It is probable that the results of this type of analysis will give nothing more than the "ups and downs" of those groups or species other than lichens; a more accurate measurement or breakdown of proportions would do nothing to change this fact until further detailed analyses can be made.

Analysis within the broad categories given above was made of the material retained by a screen of 7 meshes per inch; this was a time-saving measure, since the "screen" in this case is actually a plastic collander, with square openings of about 2.5 mm. A wire screen, such as was used in the detailed analyses to separate all except the "s.s.7" group, inevitably retains fibrous materials which must be removed with tweezers, while the plastic collander can be washed clean in a few seconds.

After making the visual analysis, the material was placed in a fresh plastic bag and stored in the original container; it was originally intended that both the analyzed material and that portion which passed through the collander would be saved. Even the suction device mentioned previously, however, proved unequal to the task of drawing off, through a retention screen of 200 meshes per inch or a piece of linen cloth, the water accompanying all of the plant material which passed through the plastic collander. Therefore, only a small portion of each sample was used, the majority, along with the large material used for analysis, being retained for possible detailed analysis in the future.

The results of the "rapid" analyses may be summarized as follows. Mosses are present in about the same amounts throughout the year. Woody plants and grasses are the most highly variable of the seven plant groups, particularly during the growing season. Grasses appear to be displaced somewhat by woody plants during at least the latter part of August; this trend is reversed slightly during late May and early June, while the two groups are present in more or less equal amounts during the rest of the year, at least during those periods for which samples were available. Lichens, as has been mentioned previously, are probably not represented in their true proportions. The apparent rise in proportions of these plants during late spring, summer and early fall, when a decline would logically be expected (due to the greater availability of succulent new growth of other types of plants) as compared to the January-February samples is, in the opinion of the writer, due to the fact that during the former period precipitation is likely to render lichens less frangible, with the result that a larger proportion of those ingested will be retained as large pieces. This would also explain the proportionally larger amount of variation during these periods.

Comparison of spring and fall samples shows, in the former, a relatively stable grass-sedge content and a quite variable proportion of woody tissue, while the reverse of this is found in the fall. This might perhaps best be explained by the theory that grasses, in the spring, are a "staple" item,with woody tissues eagerly sought but not always found, while in the fall, woody tissues are still common and steadily utilized while grasses become, for a time, a "filler" group in the occasional absence of sufficient fungi and perhaps succulent woody tissues. Those familiar with Alaska will doubtless require no reminder that the period from about the middle of August to about the middle of October is, calendars notwithstanding, thought of and here treated as the fall of the year.

Of the four most consistently appearing plant groups only the grass-sedge was not found in every sample, and even this group was absent from only a single one of the thirty-seven. Forbs were present in nine of the samples; in six of these, Dryas octopetala was the only representative of this group, while in the other three Dryas occurred in combination with traces of Lupinus and small amounts of other forbs which could not be identified.

Fungi appear most frequently and in the most consistent proportions between August 1 and the first week of September; it is believed that during this period the values given for lichens will more closely approximate the actual proportions than at other times of the year. By the end of September, fungi occur in more widely fluctuating proportions, indicating that they are still eagerly sought (perhaps, with a decline in succulent woody tissues, even more eagerly than during the earlier period) but are harder to find.

Of the woody plants, Betula nana and Vaccinium uliginosum both occurred 30 times, with the latter being present in amounts equaling or exceeding any other woody plants 23 times, as compared to 19 for the former. Salix occurred in 18 samples, in 12 of which it was present in amounts equaling or exceeding any other woody plant; three times it occurred as the least abundant, and three times as a trace. (The terms most, least, median, trace, etc., as used here should not be confused with the 5-4-3-2-1 system used to rate the plant groups as a whole; the former refer only to relative amounts within a plant group).

Vaccinium vitis idaea occurred in 15 samples, 4 times as a trace, 10 times as the least abundant woody tissue, and once in amounts intermediate between the most-abundant and least-abundant. Of the remaining woody plants, only Arctostaphylos alpina occurred more than twice and in more than trace amounts. It was twice among the "most abundant" group, twice occurred as an intermediate, and in one sample was the least abundant of the woody plants while still being more than a trace. Empetrum nigrum, Picea, Alnus, and Cassiope each occurred as a trace in a single sample, while Loiseluria occurred twice.

Bird remains occurred in two samples; but these were not included in the "other" category of food items. (A bullet found in one sample was also excluded, as were stomach villi, caribou hairs, oxidized aluminum tags and other odds and ends, and fly larvae which occurred in two samples).

Of the lichens, Cladonia occurred in every sample, and in every case was present in amounts equal to or exceeding any other type of lichen. Cetraria and Stereocaulon were present about equally, the former occurring in 19 samples while the latter was present in 16; while Cetraria equalled or exceeded any other lichens in eight of its 19 appearances, it was also present in "least" amounts 7 times and as a trace once, as compared to once and twice, respectively, for Stereocaulon. Stereocaulon occurred 8 times in medial amounts, Cetraria 3 times. Peltigera was the only other lichen to make an appearance, occurring once in the "most" classification, once in the "least", and once as a trace.

Equisetum occurred in 5 of the 37 samples, never as more than 10%; it may well occur more frequently and in greater amounts during that part of the summer for which samples are lacking.

It should be evident from the above that Betula nana and Vaccinium uliginosum are the most important of the woody plants, occurring nearly all year round, while Salix may be quite important for a short period during the summer. It is probable that both Salix and Arctostaphylos would be more consistently represented if more samples were available for the summer period. Cladonia is quite evidently the most sought-after of the lichens, Cetraria and Stereocaulon considerably less so,

with the former probably taken more as a matter of choice since the writer's observations indicate that it is present in much smaller amounts on the range than the latter. Insofar as forbs can be rated as important, Dryas octopetala far outweighs all other plants of this group for those times of the year from which samples were available.

RECOMMENDATIONS

Project should be continued.

Prepared by:

Alan M. Courtright
Biological Aid

Approved by:

Robert F. Scott
Supervisor of Game Restoration

Date: May 15, 1957

Job No. 6--Management Studies of Alaska Caribou
Range Use Studies--Nelchina Area

Period Covered: July 1, 1955 to May 15, 1957

ABSTRACT

Fifteen permanent range stations were established during 1955 and 1956 in the major winter range of the Nelchina caribou herd. Each consists of a fenced Plot A and an unfenced Plot B. The vegetation on each plot was sampled by the point-intercept method, and the results of the sampling are tabulated for each plot according to per cent coverage of the plants.

OBJECTIVES

To establish a basis for measuring and evaluating the effects of the Nelchina caribou herd upon its range.

TECHNIQUES USED

This phase of the range-use studies of the Nelchina caribou range was carried on for two consecutive years. During the two years a two-man field crew--Jack Gross and Alan Courtright in 1955, and Jim Whisenhant and Ron Skoog in 1956--established fifteen permanent exclosure stations at various locations within the main portion of the caribou's wintering grounds. These stations are to be used as a basis for measuring possible future changes in the vegetative structure that may occur on the Nelchina range as a result of caribou utilization. All the stations thus far established are accessible by airplane from lakes. Thus, the material for each station was flown to the various locations via a Grumman Goose; and, later, the field-crew and their equipment were ferried from station to station via a Piper Pacer; some work was done by boat, also.

The station sites chosen lie in representative portions of the caribou's winter range, and embrace the plant communities considered to be of importance to caribou. A station consists of two quadrats, or plots, each measuring 5 by 20 feet and each encompassing vegetation that is identical, as nearly as possible, to that of the other, both in plant species and distribution. Plot A is fenced to exclude caribou. Plot B is not fenced, and the distance between the two plots in every case is less than 100 yards. Thus, any difference detected in the future between the vegetative structures of the two plots presumably will reflect the effect of caribou upon that portion of the range in which the station lies. The plots were chosen by eye (not randomly) so that they were as nearly similar as possible, and were laid out with the long axis perpendicular to the lines of variation in the plant cover.

The vegetation on each quadrat was measured by the point-intercept method along a minimum of five equally-spaced lines parallel to the

long axis. Each twenty-foot line was divided into 100 equally-spaced points, one every two-tenths of a foot. All plants intercepting a vertical extension of each point were recorded, but each species only once; the height of erect shrubs at each point of interception was recorded also, as was the height and DBH of each tree occurring on the plot. All plants were recorded by species, or by number if unknown; specimens of unknown plants were pressed for future identification. After the sampling, the recorded occurrences of the various plant species were examined statistically. If the variance between lines was such that the sampling error for none of the dominant species was less than 10 per cent at the 95 per cent confidence level, then additional lines were established to bring the sample within the desired limits of reliability.

Photographs were taken in black and white of the vegetation occurring on each plot. Pictures of the whole quadrat were fixed by a photo point established for each plot; close-ups were taken from various positions. Black and white pictures did not disclose the detail necessary, but color photographs should provide the desired results.

Six-foot-high fences were erected around the Plot A quadrats at a minimum distance of five feet from their perimeters. The fence used in 1956 consisted of a four-foot-high section of cattle wire, topped by a single strand of barbed wire; a one-foot space at the bottom plus the wide mesh of the cattle wire (12 by 6 inches) permits the passage of small mammals. Six eight-foot steel posts driven into the ground support the fence, each cornerpost being braced with strands of smooth wire leading to deadmen (five-foot steel posts pounded into the ground). This type of fence has proved more effective than that erected in 1955, which consisted of five strands of barbed wire. The strands did not remain tight enough to prevent caribou from entering the plot and, at one station, a caribou had slipped in and out of a plot by passing under or between the barbed-wire strands. All but two of these fences have since been strengthened.

The stations were marked for positive identification. Orange-painted pipes driven into the ground at each corner outline the perimeter of each plot. An orange-painted sign stamped with the station number designates Plot A, and a similar sign stamped "Plot B" identifies that quadrat; both signs are on steel posts. Blazed trees point the way to the plots from the lake shore, where an orange-painted, stamped, metal sign bears the station number and identifies the station as a range study by the U. S. Fish and Wildlife Service. Orange-painted five-gallon cans placed on fence posts and on tops of trees permit the prompt location of each station from the air.

FINDINGS

Fourteen of the fifteen stations established in 1955 and 1956 lie on the "flat" between Lone Butte and Ewan Lake. Caribou have wintered in this area frequently in past years, although not to any great extent during the last two winters. This flat lies at an elevation averaging about 2,400 feet and covers about 2,000 square miles of the southeast quadrant of the Nelchina range. As a whole, the region is poorly drained, containing many lakes and muskeg areas. A sub-climax stand of black spruce (Picea mariana) dominates the region; the primary associated plants include willow (Salix spp.), dwarf birch (Betula nana), Labrador tea (Ledum spp.), blueberry (Vaccinium uliginosum), low-bush cranberry (V. vitis-idaea), crowberry (Empetrum nigrum), cloudberry (Rubus chamaemorus), sedges (Carex, Eriophorum, and Scirpus), and many forms of mosses, lichens, and fungi.

The fifteenth station was established at Big Lake, adjacent to Deadman Lake north of the Susitna River, above timberline at an elevation of about 3,200 feet. The immediate region is quite mountainous and well-drained, and most lies above timberline. There the dominant vegetation consists of lichens, blueberry, low-bush cranberry, Labrador tea, and crowberry, interspersed with various forms of sedges, grasses, and forbs.

Figure 1 shows the approximate locations of the stations established during the summers of 1955 and 1956. A description of the fifteen stations follows below.

Station 1:

Location--Susitna Lake, west shore; about 1½ miles south of Sutter's cabin.

Altitude--About 2,500 feet.

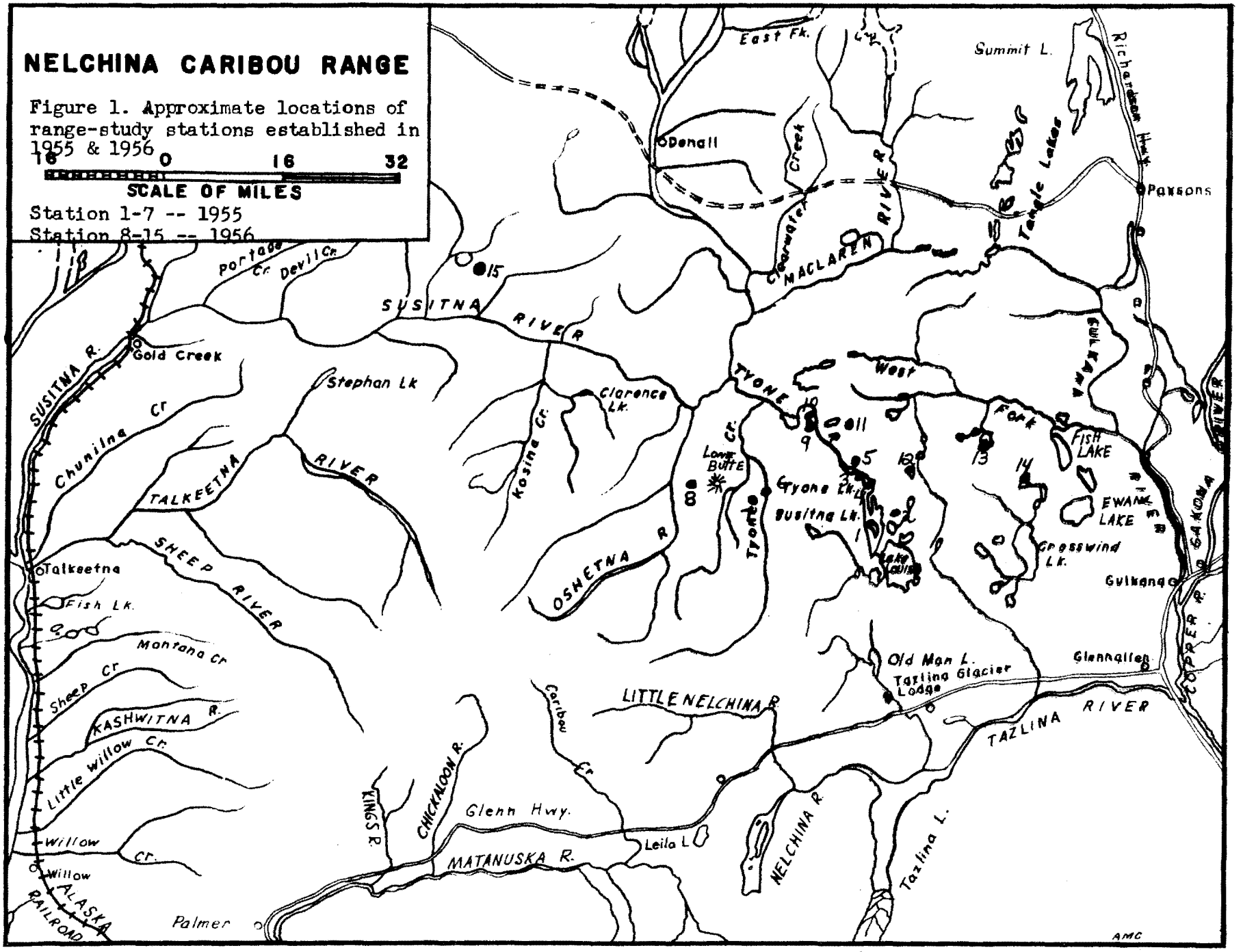
Description--Station lies about 250 yards west of the lake marker on a flat table-like land that rises above the lake. The dominant plants include sphagnum moss, dwarf birch, low-bush cranberry, Labrador tea, sedge, and fruticose lichens. The surrounding area is characterized by sparse black-spruce growth, with many clumps of dwarf birch and willow.

Station 2:

Location--Susitna Lake, east shore of eastern arm.

Altitude--About 2,500 feet.

Description--Station lies about 200 yards south of the lake marker in a poorly-drained section, its vegetation consisting mostly of sedge and sphagnum moss. The surrounding area contains the black spruce-lichen communities characteristic of the region.


NELCHINA CARIBOU RANGE
Figure 1. Approximate locations of range-study stations established in 1955 & 1956
16 0 16 32
SCALE OF MILES
Station 1-7 -- 1955
Station 8-15 -- 1956
East Fk.
Summit L.
Richardson Hwy
Paxsons
Donall
Creek
Clearwater
MACLAREN RIVER
Tangle Lakes
Portage Cr.
Devil Cr.
SUSITNA RIVER
SUSITNA R.
Gold Creek
Stephan Lk
Chunilna Cr
TALKEETNA RIVER
Kosina Cr.
Clarence Lk.
TYONE
West
Fork
EWAN
FISH LAKE
EWAN LAKE
Crosswind Lk.
Long Butte
Tyone Lk.
Susitna Lk.
Tyone Cr.
OSHETNA R
SHEEP RIVER
Talkeetna
Fish Lk.
Montana Cr
Sheep Cr
KASHWITNA R.
Little Willow Cr.
Willow
Willow Cr.
ALASKA RAILROAD
Palmer
KINGS R.
CHICKALOON R.
Glenn Hwy.
Caribou Cr
LITTLE NELCHINA R
Leila L
MATANUSKA R.
NELCHINA R
Tazlina L.
Old Man L.
Tazlina Glacier Lodge
TAZLINA RIVER
Glennallen
GAKONA
COPPER R.
AMC

Station 3:

Location--Tyone Lake, southwest shore; about 1½ miles southeast of Tyone Village.

Altitude--About 2,500 feet.

Description--Station lies about 150 yards southwest of lake marker in the black spruce-lichen vegetative cover, typical of the region. The dominant plants are fruticose lichens, sphagnum moss, and blueberry. The surrounding area is quite similar, but contains much black spruce, with thickets of dwarf birch and willow.

Station 4:

Location--Tyone Lake, southwest shore; about 400 yards southeast of Station 3.

Altitude--About 2,500 feet.

Description--Station lies about 150 yards southwest of lake marker. The vegetation is closely similar to that of Station 3.

Station 5:

Location--Tyone Lake, north shore; about 300 yards west of Tyone Village.

Altitude--About 2,500 feet.

Description--Station lies about 200 yards north of lake marker. Its dominant plants include sphagnum moss, blueberry, low-bush cranberry, sedge, and willow. The immediate area contains much dwarf birch and blueberry, plus black spruce, lichens, sedge, and the other plants common to the region.

Station 6:

Location--Corky Lake, east shore; about 10 miles southeast of Lone Butte.

Altitude--About 2,700 feet.

Description--Station lies about 200 yards east of lake marker. Its vegetation and that of the surrounding area resemble closely that of Station 3.

Station 7:

Location--Corky Lake, southwest shore; about 8 miles southeast of Lone Butte.

Altitude--About 2,700 feet.

Description--Station lies about 200 yards southwest of lake marker. Its vegetation and that of the surrounding area resemble closely that of Station 3.

Station 8:

Location--Harris Lake, south shore; about 4 miles west of Lone Butte.

Altitude--About 2,800 feet.

Description--Station lies on a low ridge about 250 yards true south from the lake marker. Both quadrats are on nearly level, but well-drained, ground and are about 25 yards apart. The dominant plants are fruticose lichens, moss, sphagnum moss, Labrador tea, low-bush cranberry, blueberry, sedge, and black spruce. The surrounding area consists of black spruce forest, interspersed with poorly-drained areas where moisture-tolerant plants exist.

Station 9:

Location--Betty Ann Lake, east shore; about 15 miles northeast of Lone Butte.

Altitude--About 2,500 feet.

Description--Station lies about 150 yards true east from the lake marker on a nearly level slope, well-drained, about 50 feet above the level of the lake. The quadrats are about 25 yards apart. The dominant vegetation includes fruticose lichens, sphagnum moss, blueberry, low-bush cranberry, Labrador tea, black spruce, and moss. A black spruce-lichen type of vegetation characterizes the surrounding area; nearby, however, is a stretch of swamp-like terrain and also a severely burned area. Station 10 was established in the latter for comparison with this station.

Station 10:

Location--Betty Ann Lake, east shore; about 15 miles northeast of Lone Butte.

Altitude--About 2,500 feet.

Description--Station lies about 200 yards true north of Station 9 in a severely burned area that once contained vegetation similar to that now common to the latter station. The burn appears to be 4 or 5 years old. The quadrats are on well-drained, nearly level ground, and are about 50 yards apart. The dominant vegetation includes moss, blueberry, horsetail (Equisetum spp.), Labrador tea, and wild rose (Rosa acicularis), with dead lichens and bare ground common.

Station 11:

Location--Georgia Lake, south shore; about 10 miles north of Tyone Lake.

Altitude--About 2,500 feet.

Description--Station lies in a burned-over black spruce-lichen community about 50 yards true southeast from the lake marker. Burn is at least 20 years old. Both quadrats are on level, well-drained ground. Their dominant vegetation includes sphagnum moss, moss, low-bush cranberry, Labrador tea, grass (Calamagrostis sp.), blueberry, fruticose and foliose lichens, horsetail, and sedge (Eriophorum sp.). The surrounding area contains much willow and dwarf birch, with a smattering of black spruce. Lichens are not numerous, but fruticose type present is erect and luxuriant.

Station 12:

Location--Gross Lake, north end; about 10 miles west of Tyone Lake.

Altitude--About 2,500 feet.

Description--Station is situated in an old burn (probably at least 30 years old), about 50 yards true north of lake marker. The quadrats are about 50 yards apart on a gentle, well-drained slope, and bear much fruticose and foliose lichens, sedge, blueberry, and moss, with willow, dwarf birch, low-bush cranberry, and Labrador tea being common. The surrounding area contains many thickets of dwarf birch and willow, with a smattering of white spruce and, more commonly, of black spruce. Fungi are rather abundant.

Station 13:

Location--Janet Lake, west shore; about 10 miles west of Fish Lake.

Altitude--About 2,500 feet.

Description--Station lies in a 5-10 year-old burn about 150 yards true west of the lake marker. Both quadrats are well-drained, and they are about 60 yards apart. The dominant vegetation includes moss, blueberry, low-bush cranberry, Labrador tea, willow, dwarf birch, and fruticose and foliose lichens. Much dead timber still stands in the surrounding area; spruce are rare, lichens abundant, and fungi common.

Station 14:

Location--Springer Lake, northwest end; about 10 miles southwest of Fish Lake.

Altitude--About 2,300 feet.

Description--Station lies in a 15-20 year-old burn about 100 yards true southwest of the lake marker. The quadrats are about 50 yards apart on well-drained, nearly level ground. Their dominant vegetation includes blueberry, fruticose and foliose lichens, willow, dwarf birch, black spruce, low-bush cranberry, Labrador tea, and horsetail. Much dead timber still is standing in the surrounding area, but black spruce is returning and is fairly common; moss, lichens, and fungi are abundant.

Station 15:

Location--Big Lake, north end; adjacent to Deadman Lake.

Altitude--About 3,200 feet.

Description--Station lies above timberline about 150 yards true east of the lake marker. The quadrats are about 30 yards apart on a gentle, well-drained slope. They contain mostly fruticose lichens, blueberry, moss, and sedge. The surrounding area is all above timberline, and contains similar vegetation; willow and dwarf birch thickets occur here and there, and aquatic plants occur in the poorly drained areas. Lichens are plentiful throughout the region.

Tables 1 and 2 summarize the plant-composition data for each station as obtained by the sampling technique used. The lichen-density figures are estimated, because the various "species" were recorded separately and some points recorded two or more such "species". In combining these into one group, only those were tallied that usually occur separately.

Many of the stations were checked during the winter of 1956-57 to see if the fences were in order and if caribou were in the vicinity. All the stations were intact, but only at Station 15 (Big Lake) were caribou wintering nearby. There, animals had fed close to the fencing around Plot A; the only tracks inside the exclosure were those of a ptarmigan. Plot B contained five pawed-out places where caribou had fed. Most of the stations established in 1955 experienced caribou use during the winter of 1955-56.

All stations will be checked from time to time and the fences kept in repair. The project is a long-term one, however, and probably many years will pass before any noticeable changes occur in the vegetation. The raw data summarized for this report is filed in the Anchorage office of the Federal Aid branch.

Table 1. Plant composition of the range-study stations established in 1955 as determined by the point-intercept sampling-technique. The figures express the per cent of the plot covered by the various plants recorded.

Plant Species	Station 1 Plot A	Station 1 Plot B	Station 2 Plot A	Station 2 Plot B	Station 3 Plot A	Station 3 Plot B	Station 4 Plot A	Station 4 Plot B	Station 5 Plot A	Station 5 Plot B	Station 6 Plot A	Station 6 Plot B	Station 7 Plot A	Station 7 Plot B
*LICHENS	18.4	23.0			85.0	90.0	77.2	86.8	9.4	22.8	90.0	90.0	87.4	78.2
WOODY:														
Andromeda sp.			1.2	6.6										
Arctostaphylos alpina								1.4					0.6	
Betula nana	17.9	23.5	2.8	3.6	2.4	6.2	0.6	0.2	6.8	6.8		1.8		0.4
Empetrum nigrum	2.6	3.5	1.0	1.0			0.1		4.6	2.0	0.2		1.8	
Ledum spp.	35.1	31.3	1.6	1.2	3.0	3.8	2.1	1.0	10.4	8.2	1.4	2.8	3.6	0.4
Oxycoccus microcarpus		2.1	0.6	2.6					5.8					
Picea mariana	0.2	0.7					4.1	0.4			1.6			
Rosa acicularis	0.3													
Salix spp.	2.7	1.3			1.8			3.4	12.6	2.4				
Vaccinium uliginosum	0.5	1.9	7.2	3.8	13.2	10.2	1.9	6.6	45.4	49.2	10.8	5.0	6.0	7.6
V. vitis-idaea	17.9	21.7	0.8	0.4	0.6	0.4	2.8	1.8	10.8	24.8	4.0	2.8	1.6	2.0
SEDGE-GRASS	11.4	11.8	55.6	54.0			8.0	1.4	24.4	6.4	8.4	3.8	2.4	2.8
HERBS	3.8	3.9	6.0	1.0					2.8	2.2	0.4	1.0	0.2	0.4
MOSS	55.3	48.8	26.6	58.8	17.0	17.0	19.0	10.2	51.8	40.6	11.4	20.4	12.8	20.0
OTHER:														
Equisetum spp.	1.0	1.0			0.4	0.2			1.0					1.8
Sphagnum sp.	Included w/Moss													
BARE	6.2	5.4	22.0	7.6	3.2	0.4	7.1	9.0	13.6	3.2	2.8	2.8	5.4	2.0

*Estimated from data.

Table 2. Plant composition of the range-study stations established in 1956, as determined by the point-intercept sampling-technique. The figures express the per cent of the plot covered by the various plants recorded.

Plant Species	Station 8		Station 9		Station 10		Station 11		Station 12		Station 13		Station 14		Station 15	
	Plot A	Plot B	Plot A	Plot B	Plot A	Plot B	Plot A	Plot B	Plot A	Plot B	Plot A	Plot B	Plot A	Plot B	Plot A	Plot B
*LICHENS	87.5	88.9	82.4	75.2	3.6	0.5	32.0	44.3	70.0	70.9	32.4	34.0	66.7	76.3	95.4	95.0
WOODY:																
Andromeda sp.															0.3	3.0
Arctostaphylos alpina	3.5	8.9	5.0	1.1	7.0	5.7			16.0	10.7	20.6	32.1	26.7	10.7	5.7	1.0
Betula nana	4.1	8.6		0.7					1.3				1.1		7.3	14.2
Empetrum nigrum	26.6	22.6	17.8	19.1	7.8	3.5	60.0	68.8	15.8	33.5	44.0	26.7	37.0	35.5	5.0	5.0
Ledum spp.	1.8	8.7					3.7				4.6			3.3		
Oxycoccus microcarpus	11.0	12.5	18.0	17.4		0.2	.	0.1					25.9	11.7		
Picea mariana			3.4	1.9	11.2				0.6	1.4	0.6	0.3		0.3		
Rosa aciculatis	4.3	5.8	3.8	9.3	5.4	15.3	1.7		19.8	19.6	20.0	21.0	13.0	18.0	1.7	
Salix spp.					T		7.3	7.1								
Spirea beauverdiana	14.5	11.6	26.8	21.7	15.4	18.5	17.6	1.3	41.9	38.9	53.2	60.1	60.7	48.1	23.4	13.6
Vaccinium uliginosum	17.1	19.3	22.4	16.3	4.7	2.1	46.3	62.0	21.0	19.9	34.2	27.6	29.6	20.4	3.7	6.6
V. vitis-idaea																
SEDGE-GRASS	14.2	4.5	9.4	15.4	13.3	26.9	23.6	31.6	22.9	31.6	0.8	2.4	4.3	21.8	9.4	13.2
HERBS	13.2	17.0	3.5	6.3	6.1	17.9	9.4	8.3	1.3	2.7	0.6	3.9		4.9	3.7	0.4
MOSS	35.0	42.8	19.1	22.9	68.8	86.8	44.3	75.3	77.6	54.2	76.2	67.7	71.2	51.3	14.3	10.8
OTHER:																
Equisetum spp.					15.9	12.4	9.6	6.7	2.1	5.1	1.8	10.9	10.4	15.8		
Fungi		T					0.4	0.1	T	0.7	0.2	0.1				
Sphagnum sp.	30.2	16.4	31.1	29.3	0.8	3.6	60.7	27.6	4.3	18.3	7.8	0.4	5.0	11.1		
BARE			0.4		14.7	3.1					0.2					

* Estimated from data.

T Trace

RECOMMENDATIONS

Exclosure fences should be maintained for the period of time necessary to detect changes in the vegetation.

Prepared by:

Ronald O. Skoog
Wildlife Management Biologist

Approved by:

Robert F. Scott
Supervisor of Game Restoration

Date: May 15, 1957

Job No. 6 -- Herd Composition in Interior Alaska

PERIOD COVERED: October 31, 1957 to December 1, 1957

ABSTRACT

Aerial composition counts were made in three specific areas subject to hunting: the Tanana Valley, Fortymile, and the lower Koyukuk Valley. Six hundred nine moose were counted in 19.8 hours for an average of 30.7 moose sighted per hour. The sex and age data are summarized as follows:

Tanana Valley: The calf:cow ratio decreased from 47:100 in 1956 to 42:100 in 1957. Survival of bull calves to yearlings indicated 35 per cent mortality. The bull:cow ratio of 68:100 indicated light hunting pressure.

Fortymile: The calf cow: ratio decreased from 53:100 in 1956 to 46:100 in 1957. Survival of bull calves to yearlings indicated 20 per cent mortality. The bull:cow ratio of 91:100 indicates light hunting pressure; however, it is believed that a disproportionate sampling of bulls may have occurred.

Koyukuk: The calf:cow ratio was 67:100 indicating a high level of productivity. Data from 1956 were not available to determine calf survival. The young bull:bull calf ratio of 48:100, however, suggested higher mortality than in other areas; perhaps due to heavy wolf predation the previous winter. The bull:cow ratio of 80:100 indicated light hunting pressure.

The calf percentage of the total herd continues at 20 and 19 per cent for the Tanana Valley and Fortymile respectively. These ratios have not changed since 1954. In the Koyukuk, there were 28 per cent calves in 1957 as compared to 36 per cent in 1954.

It is apparent that the moose populations in the Tanana and Fortymile are relatively stable and are not being affected adversely by the present hunting pressure. The Koyukuk moose herd also appears to be in healthy condition despite unusually heavy wolf predation during the winter of 1957.

The data for this study are in the Federal Aid files of the Fish and Wildlife Service at Fairbanks.

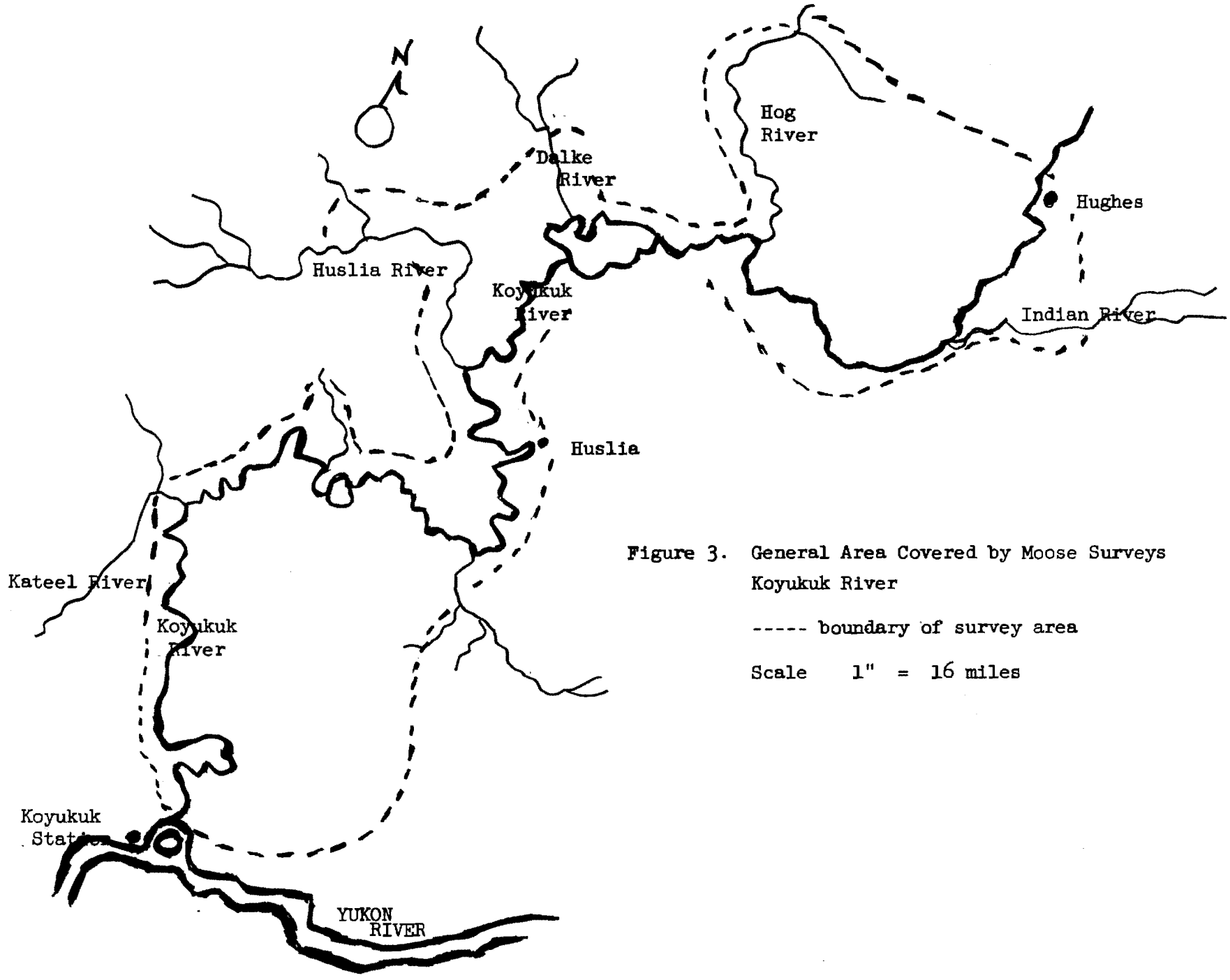


Figure 3. General Area Covered by Moose Surveys
Koyukuk River

----- boundary of survey area

Scale 1" = 16 miles

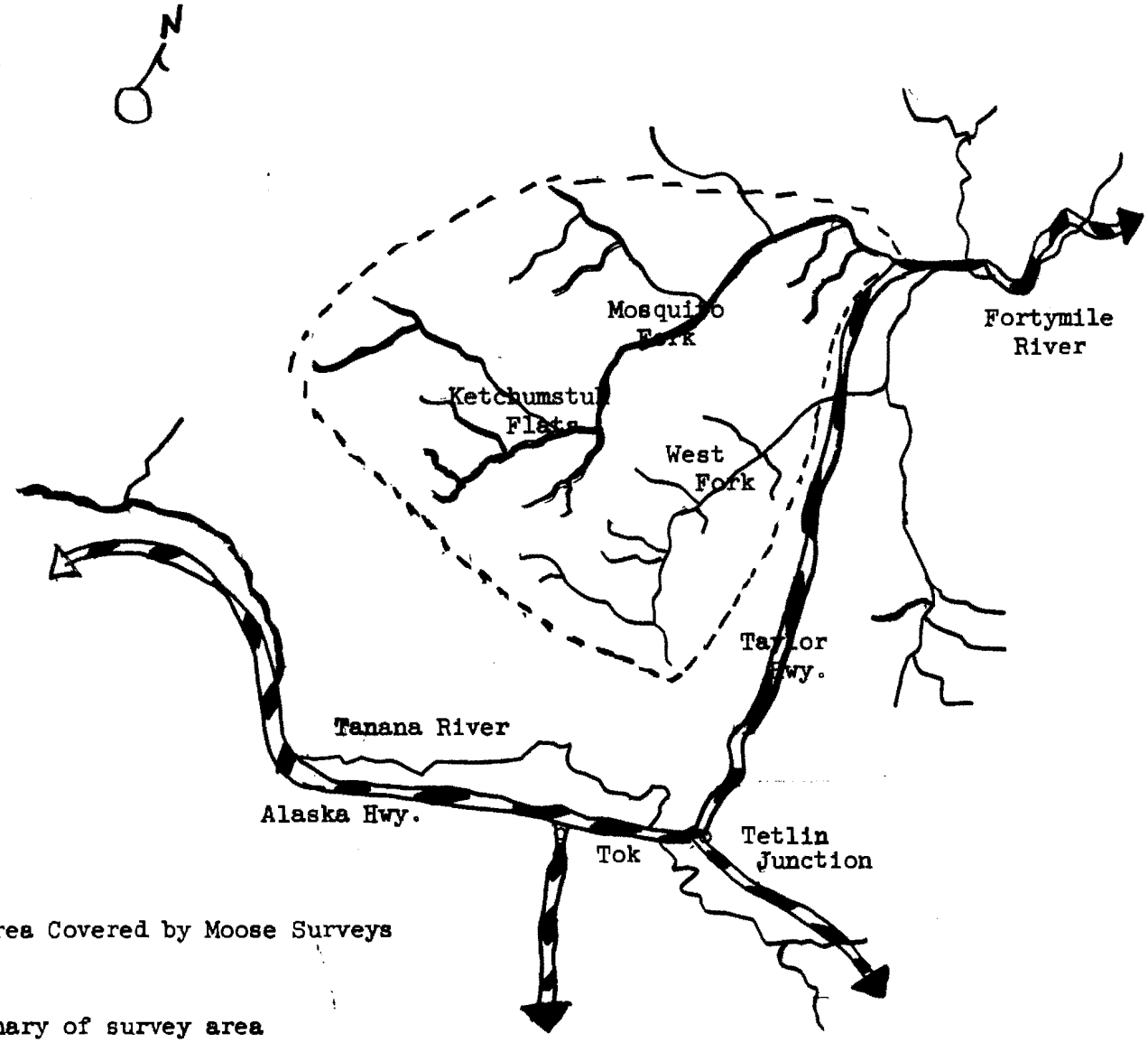


Figure 2. General Area Covered by Moose Surveys Fortymile

----- bounary of survey area

Scale 1" = 16 miles

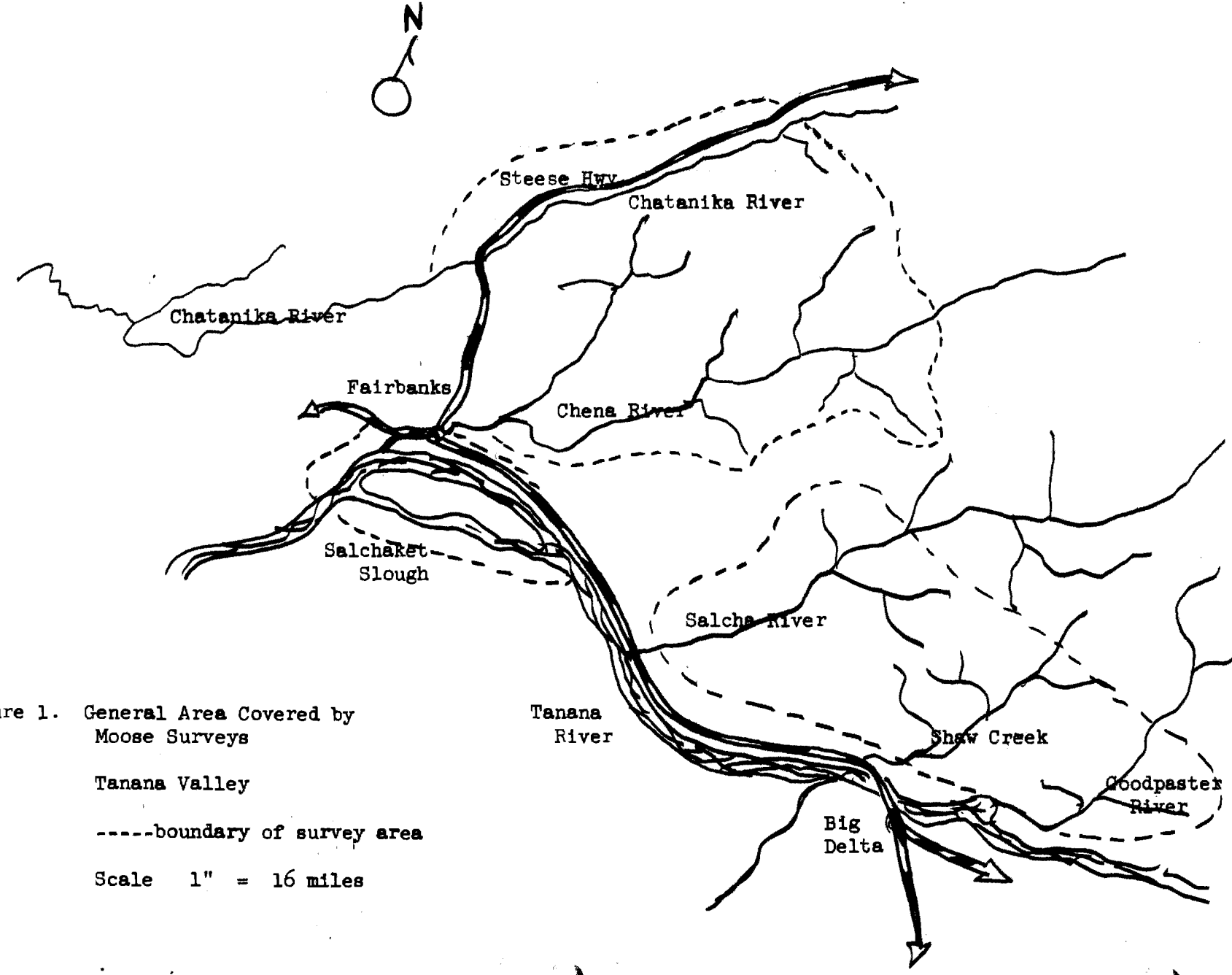


Figure 1. General Area Covered by Moose Surveys

Tanana Valley

-----boundary of survey area

Scale 1" = 16 miles

OBJECTIVES

To determine age and sex composition of local moose populations as an index to productivity and survival in areas subject to significant hunting pressure or wolf predation.

TECHNIQUES USED

During the period from October 31 to December 1, 1957, aerial composition counts were conducted in the Tanana River and tributary valleys near Fairbanks, the Mosquito Fork, Ketchumstuk Flats area of the Fortymile, and the Koyukuk flats between Koyukuk Station and Hughes. Counts were made using a Super-cub in the Tanana area, a Cessna 180 and a Pacer in the Koyukuk area, and a Pacer in the Fortymile area. Flights were made at elevations of 500-700 feet above the ground and moose were tallied in the following categories:

1. Small bulls - spiked, forked or antlers with very small palms considered to be 18 months of age. There is probably some overlap between this class and adults.

2. Adult bulls - antlers medium to large.

3. Cows - all anterless adult moose:

   (a) Without calves

   (b) With one calf

   (c) With two or more calves

4. Calves - moose 4 - 6 months old, smaller than adults.

5. Questionable - moose which could not be identified accurately due to poor visability or flying conditions.

The number of hours actually spent searching for moose was recorded for each area to determine the number of moose seen per flying hour. Sig Olson, John Klingbeil, Jack Frost and Douglas Jones acted as observers while Joe Miner, Stan Fredericksen, Harry Pinkham and Glenn Orton served as pilots during the survey.

The areas covered were essentially limited to those supporting moose populations subject to hunting pressure, wolf predation or both. Except for the area between Salchaket Slough and the Richardson Highway, the Tanana flats and Wood River areas covered in previous years were not included, since hunting pressure in these areas is negligible. The areas surveyed are shown in Figures 1, 2, and 3.

FINDINGS

A summary of all moose tallied is presented in Table 1 by area. Five hundred ninety-two moose were classified as to sex and age, plus 17 additional individuals which were not, for a total sample of six hundred nine individuals. The total flying time for the entire project, including the time spent traveling to and from the survey, was 29.8 hours. The actual time spent counting moose on the areas was 19.8 hours. The total moose seen per hour based on total flying time for the project was 20.4, and 30.7 moose were seen per hour during the time actually spent looking for moose. The number of moose observed per hour for the various areas is as follows:

AREA	NO. MOOSE SEEN PER HOUR
Tanana Valley	24.7
Fortymile	40.0
Koyukuk	34.6
All areas combined	30.7

The number of moose seen per hour is undoubtedly low, since conditions for observation were extremely poor. Snow cover was light; consequently, low brush, grass, stumps, windfalls and rocks projecting through the snow presented constant distractions and hampered the observer's ability to see moose as compared to spotting moose against the relatively even, overall snow cover prevailing in prior years.

Moose were not observed in sufficient numbers to allow statistical analysis of the comparative differences in herd composition at different elevations. No moose were observed above timberline; the majority being located along the tributary creeks and main river bottoms and flats. The herd composition for all areas surveyed is summarized and presented in Table 2.

PRODUCTIVITY

Tanana Valley Area - The calf:cow ratio dropped slightly from 47:100 in 1956 to 42:100 in 1957. This is the third year that this ratio has decreased (53:100 in 1955). Despite this fact, productivity can be considered good. Althouth it is assumed that the cow segment of the herd is the most constant, it is possible that the percentage of yearling cows has increased due to good survival, and the calf:cow ratio consequently would decrease. The calf percentage of the total

herd still remains at 20 per cent; the same level maintained since 1954, which would tend to indicate a uniform level of production. The ratio of twin calves per 100 cows dropped to the lowest point in three years (2:100). Outwardly, there appears to be a slight downward trend in productivity over the past three or four years. A more direct comparison between 1956 and 1957 is possible by excluding the Tanana Flats and Wood River counts for both years, using only those counts from the Chena River, Chatanika River, Shaw Creek, and the Goodpaster River. It is evident in Table 2 that the data indicate very little change in the past two years in this area.

Fortymile - The productivity index in this area decreased somewhat from the previous year. Calves per 100 cows dropped from 53:100 in 1956 to 46:100 in 1957, and the percentage of calves dropped from 24 to 19. Despite this fact, productivity in this area still is on par with the Tanana Valley as well as areas south of the Alaska Range. Eight cows with twin calves were observed in the Fortymile as compared to no cows with twins per 100 cows with calves in 1956.

The reduced ratio of calves per 100 cows in 1957 might have been caused by good calf survival from 1956 resulting in a larger number of non-breeding yearling cows. In 1956, 28 cows without calves and 31 cows with calves were tallied (90:100) as compared to 34 cows without calves and 23 with calves (148:100) tallied in 1957.

Koyukuk - The Koyukuk area showed the highest level of productivity of any of the areas surveyed. The calf:cow ratio was 67:100 and the proportion of calves in the total herd was 28 per cent. A further indication of relatively high level of production was the incidence of cows with twin calves (23 cows with twin claves per 100 cows with calves). The only comparable data available from previous years for this area was obtained in 1954. Production was very good at that time as indicated by a calf:cow ratio of 86:100 and a calf percentage of 26. The ratio of cows with twin calves was also very high, 36:100. It is evident that during the past four years, the level of productivity in this area has been very high.

Unusually heavy wolf predation, aggravated by a deep crusted snow condition during the winter and early spring of 1957, was apparently an important mortality factor. During March, the bounty hunter team of Stickman and Huntington counted 175 dead moose believed to be wolf kills in 123 hours of flying time.

TABLE 1

SUMMARY OF MOOSE POPULATION COMPOSITION COUNTS
TANANA VALLEY, FORTYMILE, AND KOYUKUK
NOVEMBER - DECEMBER 1957

AREA	BULLS			COWS				CALVES	UNIDENTIFIED	MOOSE	ACTUAL FLYING TIME	MOOSE SEEN PER HOUR
	YOUNG	ADULT	TOTAL	WITHOUT CALF	WITH 1 CALF	WITH 2 CALVES	TOTAL	TOTAL		TOTAL	TOTAL	
TANANA VALLEY												
Chena, Chatanika, Shaw, Salcha Cr., Goodpaster	14	38	52	44	31	1	76	34	6	168	7.8	21.5
Tanana River (Salchaket)	3	15	18	26	15	0	41	15	0	74	2.0	37.0
Above areas combined	17	53	70	70	46	1	117	49	6	242	9.8	24.7
FORTYMILE												
Mosquito Fork, West Fork, Kechumstuk	12	42	54	34	23	2	59	27	1	141	3.5	40.0
KOYUKUK VALLEY												
Hughes to Koyukuk Hog R., Huslia R.	14	56	70	42	35	11	88	58	10	226	6.5	34.6
GRAND TOTAL	43	151	194	146	104	14	264	134	17	609	19.8	30.7

TABLE 2

SEX AND AGE RATIOS - TANANA VALLEY, FORTYMILE AND KOYUKUK - 1957
(Comparison with 1954, 1955, 1956 in Tanana Valley and 1956 in Fortymile)

AREA SAMPLED	YEAR	TOTAL BULLS PER 100 COWS	YOUNG BULLS PER 100 AD. BULLS	CALVES PER 100 COWS	TWIN CALVES PER 100 COWS W/CALVES	CALF % OF TOTAL HERD	YOUNG BULLS % OF TOTAL HERD	YOUNG BULLS PER 100 BULL CALVES	TOTAL NUMBER MOOSE IN SAMPLE
TANANA VALLEY									
Chena, Chatanika, Shaw Cr., Salcha, Goodpaster	1957	68	37	45	3	20	8	82	162
	1956	68	30	43	19	20	8	77	93
Tanana (Salchaket)	1957	44	20	37	0	20	4	40	74
Above areas combined	1957	60	32	42	2	20	7	69	236
	1956	83	25	47	5	20	7	71	405
	1955	123	--	53	13	19	18	186	410
	1954	85	--	47	5	20	13	127	109
FORTYMILE									
Mosquito Fork, Ketchumstuk, West Fork	1957	91	29	46	8	19	8	89	140
	1956	66	30	53	0	24	7	60	129
KOYUKUK RIVER									
Koyukuk R. (Huslia to Hughes, Hog River, Huslia River)	1957	80	25	66	23	28	6	48	216

TABLE 3

YOUNG BULL:BULL CALF RATIOS
(TANANA VALLEY & FORTYMILE)
1956-57

AREA	1956			1957			PERCENT MORTALITY
	TOTAL COWS	TOTAL BULL CALVES	BULL CALF TOTAL COW	TOTAL COWS	TOTAL YOUNG BULLS	YOUNG BULLS TOTAL COWS	
TANANA VALLEY							
Chena, Chatanika, Shaw Cr., Salcha, Goodpaster	44	9	21:100	76	14	18:100	14%
Tanana (Salchaket)	95	23	24:100	41	3	7:100	70%
Above areas combined	139	32	23:100	117	17	15:100	35%
FORTYMILE							
Ketchumstuk, Mosquito Fork, West Fork	59	15	25:100	59	12	20:100	20%

The young bull:adult bull ratio in all areas ranges from 25 to 32 per 100 and is indicative of good overall production. It further reflects the light overall hunting pressure exerted on these herds. In general, productivity can be considered good despite a slight downward trend from previous years for all three areas surveyed, and it compares favorably with the Susitna-Matanuska area as well as the Copper River Basin.

SURVIVAL (to 18 months)

Survival of young bulls (to 18 months) can be measured in one of two ways, i.e., the ratio of young bulls to bull calves of the year or the ratio of bull calves to total cows for the past year as compared to the ratio of young bulls to total cows for the current year. The reliability of the former depends primarily on uniform calf production from year to year. The latter assumes that since cows are not hunted and subject principally to natural mortality factors, this segment of the population is probably the most constant and thus probably provides the most reliable index to survival. The ratios of bull calves and young bulls to total cows for 1956 and 1957 respectively, are presented in Table 3.

Tanana Valley - The 1956 counts indicated a bull calf:total cow ratio of 23:100 and the 1957 counts showed a young bull:total cow ratio of 15:100, indicating 35 per cent mortality. Only a moderate loss of young male animals, probably mostly due to hunting is evident.

Fortymile - The bull calf:total cow ratio derived in 1956 was 25:100 and the young bull:total cow ratio similarly derived in 1957 was 20:100, thus showing a 20 per cent mortality. This reflects a relatively high level of survival and the light hunting pressure exerted in this area. The ratio of 89 young bulls per 100 bull calves in 1957 tends to substantiate the above although it is apparent that the latter figures indicate a lesser degree of mortality.

Koyukuk - There are no data available for 1956 from which to derive a bull calf:total cow ratio. Therefore, it is not possible to determine the survival of young males to 18 months on this basis. The young bull: bull calf ratio (48:100) suggests considerably heavier mortality of young bulls than observed in other areas. This cannot be interpreted as an accurate figure, however, since there is no way in which to ascertain whether or not calf production has been constant in this area from year to year. It may, however, reflect the allegedly heavy wolf predation during the previous winter.

If predation resulted in a weak yearling male class, it is logical that the female segment of the yearling class was similarly affected. Conceivably, predation in the Koyukuk area should have taken a proportionately larger toll of the calves, the most vulnerable age class, thereby affecting the yearling class represented the following fall. Yearling females are generally non-breeding and comprise a portion of those cows recorded as "cows without calves". The areas with no serious predation problem should show a little higher ratio of cows without calves compared to areas where heavy predation has occurred. In the Tanana Valley and Fortymile area, the ratio of cows without calves to 100 total cows was 60:100 and 58:100 respectively. In the Koyukuk, the ratio was 48:100. Since the yearling bull:bull calf ratio also indicates the possibility of a higher degree of mortality than elsewhere, it is possible that wolf predation would have materially affected survival of the 1956 calf crop in the Koyukuk area.

EFFECTS OF HUNTING

Tanana Valley - The bull:cow ratio of 68:100 in the tributary stream valleys and ratio of 44:100 in the Tanana flats indicates an overall light to moderate hunting pressure in these areas. The ratio for the entire area is 60:100 and it is believed that the current hunting pressure is in no way detrimental to the moose population at present.

Fortymile - The bull:cow ratio (91:100) in this area is high and does not seem comparable to the ratio obtained in 1956 (66:100). This ratio suggests disproportionate sampling of bulls. Although a questionable ratio has been obtained in the current counts, there is no doubt that hunting pressure is not significant enough to substantially affect the number of bulls in the population.

Koyukuk - Three native villages (Hughes, Huslia and Koyukuk) have ready access to the area. Hunting is restricted principally to those areas along or immediately adjacent to the rivers and streams navigable by river boat. The ratio of bulls to cows is high (80:100).

Hunting in all the areas surveyed is limited, for the most part, to the navigable streams and rivers, roads and the areas immediately adjacent to them. Some moose are taken by aircraft as well, however, this accounts for a comparatively small segment of the kill. Very few moose are taken over a half-mile from a route of travel, which leaves the major portion of these areas unhunted. The road network out of Fairbanks receives heavy pressure during the moose season and there is

no doubt that the bull population in local areas is depleted temporarily. The large surrounding untapped reservoirs, however, serve to replenish these areas over a period of time and the general effect of hunting on the population as a whole is insignificant at present. Likewise, the hunting in the Fortymile (Taylor Highway) is nearly all accomplished from the road leaving the area a half-mile or more from the road practically untouched.

There are no roads in the Koyukuk region, thus travel is restricted to river boats and an occasional airplane. It is again obvious that the area effectively hunted is only a small portion of the region as a whole, and hunting in itself is not an important decimating factor at present.

RECOMMENDATIONS

Herd composition counts in the Tanana, Fortymile and Koyukuk areas should be continued.

Prepared by:

SIGURD T. OLSON
Wildlife Management Biologist

Approved by:

ROBERT F. SCOTT
Supervisor of Game Restoration

DATE: January 31, 1958